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EDITORIAL NOTES.

Electricity Charges and "Undue Preference."

A JUDGMENT of the highest importance to the gas industry has been delivered by Mr. Justice Sargant, in the case in which the Long Eaton Gas Company moved the Attorney-General to complain of, and to seek to restrain, a breach by the District Council of their statutory obligations under sections 19 and 20 of the Electric Lighting Act, 1882. The judgment is no less important to the electricity supply industry, as it will assist it to clear away some of the rather confused and vague notions which exist even at the higher levels of its intelligence as to the degree of contortion of conditions that may be indulged in the fixing of tariffs in order to offer inducement, which oftentimes means preference, for the securing of additional business. The gas industry has suffered a great deal from the licence practised by their electrical competitors in the making of terms, which licence, there has been good reason to believe, has frequently carried them outside the bounds of their statutory powers. What the Long Eaton Council have been doing in the circumstances of which complaint was made has been declared by Mr. Justice Sargant as having been in excess of their powers. This is not an isolated case. In other quarters, there are various other conditions that have been applied to the electricity business which, it is considered, show an "undue "preference" to certain consumers—for instance, to those who, on condition that they take the whole of their supply for lighting from the electricity suppliers' cables, get an undue advantage, without reference to quantity and time, over a consumer who only uses electricity for part of his lighting, although he may be, quantitatively and profitably, equally as good a consumer as the all-electric one. There are likewise certain innovations in tariffs, under which the possibility of "undue preference" is traceable; and there are cases in which it is possible the average charge per unit, taking the total payments, may illegally exceed the statutory price per unit. We (as does Mr. Charles Carpenter, D.Sc. through our "Correspondence" columns) congratulate the Long Eaton Gas Company on having brought this action, and upon having secured this judgment; and especially, Mr. George Stevenson, their Engineer and Manager, upon the robust belief he has shown in the soundness of the grounds for complaint, and his Chairman (Mr. John Marshall, J.P.) and the Directors upon the whole-hearted support they have given him in following this matter up to the present satisfactory issue. This Long Eaton judgment, we are of opinion, will for all time mark the beginning of the settlement of the grievances which the gas industry has against the electrical industry in respect of unfair competition.

The judgment of Mr. Justice Sargant is valuable to the two industries concerned not only for the dictum on the issue submitted to him, but because, in the well-considered judgment, his Lordship has carefully and clearly presented the reasoning on the evidence laid before him by which he has arrived at the conclusion that, at Long Eaton, in the circumstances as related, undue preference was shown to certain of the consumers. Now what are the conditions of which complaint was made? Not that one price was charged to power consumers and another price to lighting consumers, or that a scale of differential charges was arranged according to amount of consumption, but that the power consumer who did not use electricity (or who only used it partly) for lighting purposes was charged a higher price per unit for the energy consumed for power than the power consumer who also used electric current for lighting. The Gas Company submitted that this was an infraction of the sections named, that "every company or person . . . "shall be entitled to a supply on the same terms on which "any other person . . . is entitled under similar cir-"cumstances to a corresponding supply," and that "the "undertakers shall not, in making any agreements for a "supply of electricity, show any undue preference." The judgment simply rends to pieces the fragile case that was presented to his Lordship by the District Council, with the view of convincing him that what they had done was not a violation of the conditions laid down by the Legislature, although the case was supported by Mr. J. F. C. Snell, who found it difficult, with all his adroitness, to parry successfully certain direct practical questions which were forced home during his cross-examination. Energy supplied for power to one consumer and energy supplied for power to another consumer are "corresponding" supplies; and energy furnished for lighting to one consumer and energy furnished for lighting to another consumer are likewise "corresponding" supplies. If any differences in price are allowed, this must be because the circumstances of the power or the lighting supply are different; otherwise, there will be undue preference shown to one or the other consumer. From a critical examination of all the facts, figures, curves, and statements put before him, his Lordship entirely fails to see that the circumstance of one power consumer using electricity for lighting is in itself a sufficient variation of circumstances to allow him a preferential price for power. One power user must not be charged less than another power user for the energy required for this specific purpose merely to overcome his reluctance, or to induce him, to become a consumer of current for lighting purposes; but, to justify a lower charge to him, it must be shown that he, taking energy for both power and lighting, is less costly, and therefore more profitable, to supply for power purposes than the other power consumer. Unless this can be done, then the case in justification of the lower charge fails.

The onus of showing that the supply is less costly, and therefore more profitable, falls upon those against whom the allegation of showing "undue preference" is preferred. Mr. Justice Sargant not only stated expressly in words, but also indicated by his handling of the curious tangle in which the Council and their representatives got involved, that the technical case for the Council was "extremely thin," and that they had entirely failed to discharge the obligation of justifying their action. As a matter of fact, his Lordship showed from the figures that the action of the Council in giving preferential prices to power consumers who exclusively used electricity for lighting, instead of being more profitable to the undertaking was an absolute detriment to it. The lightsome manner in which our electrical friends constantly talk of such action as this securing extra business did not carry weight with his Lordship. Mr. Snell tried its effect; but the answer he now gets is that this is an "inad-"missible reason" for the action of which complaint is made. For justification one has to go farther than that, and that is where his Lordship found the errors, administrative and technical, which he was invited to endorse. The path to this was furnished by Mr. Snell when he had to admit that, as the load factor for lighting was much worse than that for power, a customer for both power and light has in general a worse load factor than a customer for power only. "For, inasmuch as he takes his maximum load for light "from time to time concurrently with his maximum load "for power, his total load factor is a mean between the "worse load factor for light and the better load factor for "power, though the lower load factor for light may be, and "should be, if the relative prices for light and power are "fair, compensated for by the higher price per unit charged "for light." There is nothing to prevent the peak load for lighting being coincident with the peak load for power in the winter months. Indeed, whether looked at from the seasonal point of view in regard to lighting, or from the point of view of variation in demand for power according to work to be done, or from the point of view of the incidence of power demand as between one factory owner and another, there is nothing whatever in the conditions at Long Eaton that can show that the supply of a power and exclusive

electric light user at a lower power rate than that charged to a power user only is justified. It is quite conceivable that the latter might, in certain circumstances, be a much more profitable consumer than the former; yet the former has preference shown him, because he employs electricity for lighting. His Lordship showed that what had actually happened in the case of the Long Eaton consumers to whom the "undue preference" was given was that they only paid £34 3s. 2d. extra for 81,069 units used for lighting purposes. "Now not only are these units nearly one-tenth of the units "taken for power, for which £2799 18s. 4d. is paid, but, "having regard to the difference in load factor between light "and power, they must require an installation of probably "about one-third of the machinery which is required for the "power units taken by these consumers. . . . If 1d. "per unit is the proper sum for the supply of power, and "3d. per unit is the proper sum for the supply of light, it is "obvious that the supply of light to these consumers causes "the Council an extraordinary loss." In other words, 81,069 units, which ordinarily would, at 3d. per unit, cost £1013 14s., are in fact supplied for £34 5s. 2d. Do the Council still fail to see the "undue preference?"

From no point of view could his Lordship reconcile the action of the Council in this matter with their statutory obligations under sections 19 and 20 of the Act of 1882; and he told the Council plainly that there was very strong indication that the sole reason for making the differentiation was not the relative cheapness of supplying the power-lighting consumers, but a desire to oust the lighting competitor. We are afraid, and, in fact, are sure, that there are many electricity suppliers who could not technically justify some of their prices, and certainly could not show that they were innocent of "undue preference." We hear a lot about calculations being made with mathematical precision in order to arrive at accurate charges for electricity supply; and hands are held up with well-simulated pious indignation when prices are challenged. But here before Mr. Justice Sargant we have the spectacle of an effort being made to justify, on technical grounds, a change in conditions which produced differentiation and preference, and which was confessedly made by the Council for no other reason, and with no other spur or thought, than to induce the factory owners employing power to exclusively employ electric current for lighting. Furthermore, the Council gave Mr. Justice Sargant an opening for accusing them of having little idea as to what they were prohibited from doing in respect of their statutory obligations.

We are not aware at the time of writing whether the Council will appeal; but perhaps the reasoning throughout the judgment before us will help them to a speedy decision. Anyway for them, and other electricity suppliers like them, the judgment on this question of differential prices which can be shown to be an "undue preference" will produce anything but comfortable feelings; and we rather think that smart steps will be taken by not a few to obliterate, by discontinuance, a condition of things pronounced to be illegal. In concluding this somewhat lengthy review of the case, a point may be mentioned that should interest our electrical readers. When the Company were first legally advised on this matter, they offered to have it dealt with in a friendly manner, by referring it to the arbitration of an independent competent authority. The Council, however, preferred to pursue a course which finds no justification in Mr. Justice Sargant's judgment. The fact that they made the offer of arbitration entirely relieves the Gas Company from any charge of having acted in a hostile spirit.

Del Monte Process and Profits.

THERE has been a lapse of twelve months or so since the Del Monte low-temperature carbonization process strove, through the motor world and the daily press, to make a stir as the immediate saviour of the former from the oppressive dominion of the overseas suppliers of motor fuel. Things were at the time represented as being all rosy, and the prospects quite brilliant. Then Mr. W. J. Atkinson Butterfield, M.A., F.I.C., at the instance of one of our daily contemporaries, made an investigation of the process, with the result that he showed conclusively that the beating of the big drum had been of far too noisy a character. The best that he could find could be accomplished under the conditions of the existing plant was a profit of about 1s. 6d. per ton; the plant and process being defective and restricted in various particulars. A change has come over the scene. There has been fresh work on the plant; and an experimental one has been constructed on revised lines. Mr. Butterfield now appears as the author of a report upon a test that he has made with the new plant, with a balance-sheet which he considers will be fulfilled under working conditions. It is because Mr. Butterfield is the author of these documents that they deserve serious consideration, inasmuch as we have never known him to lend his name to any scheme that was not technically sound. It may be the report is but a preliminary to financial and company-promoting developments; but this aspect of the matter has nothing whatever to do with Mr. Butterfield. He has made his investigation, and founded his estimates upon that investigation; and the results are open to criticism.

We are at a disadvantage in making a complete examination of the report, as one has not been forwarded to us—whether designedly or not cannot be said. We learn, however, from such parts as have been published in a motor contemporary that Mr. Butterfield is now of opinion that "the process and plant, in its present form, can utilize "cannel for the production of oil more economically and "efficiently than any other known process and plant." It is with cannel [the deliberate use of the descriptive word "cannel" looks almost as though it was intended as a qualification] that Mr. Butterfield's trial was made, and with 1 ton only; and on the results from this single ton he bases an estimate for a 500-ton per day plant, costing £185,000, and producing in the course of a year a net profit nearly equivalent to two-thirds (£112,894) of the capital expenditure. Therefore in a year and four months the whole of the capital outlay could be wiped out if no distribution of profit were made during that period, and the lucky shareholders could thereafter rejoice in a golden condition that would be, we should think, without parallel in the trading world. We are inclined to think Mr. Butterfield's estimates are financially and in the matter of product on the top side; while the capital expenditure to justify his estimate is rather on the low side. The estimate as to the capital outlay on a 500-ton plant (£185,000) is not Mr. Butterfield's; it is a calculation based on figures adopted by him as obtained from the manufacturers of plant. A free site for the plant at the Ballycastle pithead is available. If we take the estimated cost of the cannel (7s. a ton), and divide by it the annual expenditure on cannel (£63,000), we see that Mr. Butterfield has arranged for the carbonization of 180,000 tons of cannel a year; and, at 500 tons per day, this will take 360 days out of the 365 (including Sundays and holidays). Thus only five days are allowed by him for repairing and maintaining the large plant. Mr. Butterfield is trying to get out of the plant too much work; and his expectations and estimates, we are afraid, will fall short of the present figures. He should certainly allow a larger margin than five days' rest for repair and maintenance, or a larger margin of plant to meet contingencies, if he desires his estimates to come out approximately right.

The financial estimates are based on the results from the single ton of Ballycastle cannel. It seems to have been a remarkably good ton; and there is no assurance that the Ballycastle cannel will continue to deserve such good report. Doubts are emphasized because Sir Boverton Redwood, in a report accompanyiug the one under notice, states that a sample of cannel that he received contained less volatile matter than the sample tested by Mr. Butterfield; and therefore it could not yield so much oil. Still the results, Sir Boverton says, were "quite satisfactory." But it is equally evident they were not so good as those of Mr. Butterfield. It is observed that the process does not now aim at producing smokeless fuel for the domestic market in the shape of coke—in fact, cannel coke, being small and containing such a large percentage of ash, would not be of service in this connection. The process is now confined to making profit from oil, pitch, and sulphate of ammonia. The coke (such as it is) appears to be completely gasified under ammonia-recovery conditions; and this, there is no doubt, accounts for the large yield of sulphate of ammonia that is claimed in the balance-sheet—54½ lbs. per ton of cannel. There is no analysis of the Ballycastle cannel at hand; but the nitrogen of cannels usually runs out to about the same as that of caking coals—from 1 to 2·5 per cent. So here, again, the Ballycastle sample must have been good in respect of nitrogen. It is not suggested that anything more has been claimed for the products from the ton of cannel than Mr. Butterfield secured; but we have had a pretty big experience of what a careful worker can do with a trial carboni-

zation plant and a comparatively small quantity of material compared with the results achieved when a 500-ton plant is set in operation under daily working conditions. The other figures as to products may also be taken as being top ones —the 17·4 gallons of motor spirit, the 17·6 gallons of heavy fuel oil, the 37·5 lbs. of paraffin wax, and the 51 lbs. of pitch. Sir Boverton Redwood evidently does not expect these figures to be reached in practice; and in his report he recedes a little from them. He says it may be anticipated that a ton of the material will give from 14 to 15 gallons of motor spirit, from 14 to 15 gallons of oil fuel, from 32 to 33 lbs. of paraffin wax, and about 40 lbs. of pitch. He therefore also discounts the figures to some extent. There is the question of the quality of the liquid products. The extracts from the two reports before us do not say anything at all on this point. There was a time when tar distillers were not favourably disposed towards cannel tar, in view of the fact that the same purity of product could not be obtained as from ordinary coal tar. The motor people do not want a motor spirit with a large percentage of sulphur in it; and it would be of interest to know how the motor oil from cannel stands in this regard. The price of sulphate of ammonia is not quite £12 1s. 6d. per ton to-day. Whether the market conditions, in view of the strong interests concerned in the oil world, would continue to support the other prices cannot be said; but anyway we should be reluctant to accept the fulfilment of these estimates under working conditions.

There is no necessity to go over the other items composing the balance-sheet. But, if everything works out properly—if the cannel throughout is of a quality approximately uniform with that tested by Mr. Butterfield and spoken of by Sir Boverton Redwood, and if markets are favourable (a few other "ifs" might also be added)—there ought to be profit in the process, but whether to the extent of 12s. 6·5d. per ton (which compares with Mr. Butterfield's 1s. 6d. a year ago, with other plant, other coal, and other working conditions), we are not prepared to say, although quite prepared to doubt.

Improvement in Gas-Cooker Efficiencies.

In this week's issue, there is a further article on the subject of improved gas-cooker efficiencies; and it will be interesting to our readers to learn that the two firms whose work in this direction has now been noticed in our columns—the Richmond and the Davis Companies—have simultaneously, to our knowledge, been working to the same end. It was not our business to divulge to the one or the other of the firms or to "Journal" readers, until authorized to do so, the confidential information in our possession; and even now we are not at present at liberty to describe the details of construction by which they have arrived at, and hope to still enhance, the higher heat efficiencies both in the oven and on the top-plate. But this we may say, that the two firms mentioned are not the only ones who are investigating the question of adding economy to the already economical methods (comparatively with other systems) of cooking in an oven and boiling on the top-plate—and not only economical methods, but ones that are regulatable, promptly acting, and dependable. This, too, we may say, that those who are working at the matter are proceeding on the same principles, although differing in the details of what they are doing. What are these principles? It does not require much consideration to discover them; for although the modern gas-cooker, through the cheapness of the B.Th.U.'s furnished by the gas used, is an economical domestic appliance, at the same time we cannot say that there is much that is scientific about the lines of its extraordinarily plain construction. The simplicity of its anatomy, however, has been one of the causes of the rapid popularity of the gas-cooker; for it has meant initial cheapness and low costs of maintenance. But there is not the slightest reason why these virtues should not be retained, and yet greater heat efficiency effected.

However, as intimated above, the principles which should be followed in improving the gas-cooker internally and externally are so obvious that more than the two firms whose names are mentioned above are working, in their own manner, along the same lines. In considering the question of the oven, they have each seen that there is no sense in admitting at the bottom a volume of air much greater than is required for the secondary supply to the gas-jets. Passing through the oven a larger volume of air than is needed merely means the absorption by the excess air of a fairly large quantity of heat; and so regulation by ensuring the approximately correct ingress and egress of air must raise the economy of the oven. How this is being accomplished will be the matter of descriptive articles in due season. But what does it mean? We have seen, by the devices adopted, savings in consumption of as much as 3 to 4 cubic feet per hour at cooking temperature, employing the best of modern ovens for comparison. Multiply this saving by the hours the ovens are in use in the course of a twelvemonth, and it will reach in most households a considerable amount. The oven is the only part of the gas-cooker which our electrical friends care to attack seriously; and this they do on information that is defective and cannot be justified. Yet they cannot show equal economy and reliability with their own complicated ovens—to which reference is made elsewhere in our "Electricity Supply Memoranda"—and these further savings in gas consumption in the oven will remove the electrical people, with the low thermal value of their commodity, still farther from competing with the gas industry for the gas-cooking business. We know that they will say, unless anticipated, that the improvements cannot apply to the three million and more gas-cookers now used in the United Kingdom. But knowing how the improvements are being effected, we do not see the slightest reason why—when and as cookers come in for cleaning and the renewal of parts, and when the cooker makers have completed the work in hand—the necessary alterations should not be applied to the present type of cookers.

The improvement of the top-plate is even more important than the oven. There, again, the two makers named, and certainly one other, have hit on the same points where present waste arises; while the details of the methods that are being applied are again different. Consider the boiling-ring, and the directions in which heat is lost. There is nothing to direct a considerable part of the heat of combustion on to the utensil to be heated. A large part of the heat does pass through the vessel into the contents. But there are placed above the jets the means of heat conduction. All around the burners there is an open way for the lateral escape of heat. There is free passage for an upward flow of air, which absorbs a further unnecessary number of heat units. Why continue this waste? It is not enough to reply that convenience, rapidity of work, and low cost of boiling with the present means are all-sufficient, and that they beat the electrical method out-and-out. If there is waste, let it be suppressed as far as possible, and make the gas-cooker—both oven and top-plate—as unassailable as may be. Our electrical friends will not look with favour upon this improving work upon the gas-cooker following so closely upon that which has made the gas-fire so efficient and so popular that less and less is heard of what is called an electric radiator, but should truly be called an electric convector.

Investments and Taxation.

It is not our business to discuss the nation's fiscal interests from the political point of view; but regarding the new Budget there are one or two aspects consideration of which can be approached from the industrial standpoint. The increased burden on what are called "unearned incomes" (which term has a harsh appearance and sound to some people whose capital consists of money that they, by their labour and frugal habits, have succeeded in accumulating) is not a matter that can be viewed with equanimity by those engaged in industrial enterprise. The additional taxing of unearned incomes must have the effect of making money harder to raise, or, at any rate, making people look round for investments that promise a higher rate of dividend and interest. Gilt-edged securities have depreciated violently the last few years; and they never will regain the measure of favour that they at one time possessed. People want more income from their investments; and a tax of 1s. 4d. in the pound is not something that will be conducive to such securities recouping some of their old favour. The same applies to cheap capital for industry. It cannot be obtained now at the rates that formerly ruled; and industry has consequently to pay more than was its wont for its money. It has had to pay more still of late years, during which the income-tax has stood at 1s. 2d. in the pound. The 1s. 4d. income-tax will not make investors look with any more favour on low-interest bearing capital. Though higher dividends and rates of interest are wanted, industry finds it more and more difficult to earn them with enhanced prices of labour and materials, and higher taxation to meet.

People, however, must have somewhere to invest their money; and the diverting of capital abroad has been going on somewhat freely the last few years. One object of this has been to escape the heavy taxation to which capital is subjected in this country. The Chancellor of the Exchequer, however, is hoping now to supplement the country's revenue by bringing more of this foreign placed capital into contribution. It is only right that people who live in this country should bear their share of its burdens and cost of upkeep; but it is a matter of honour whether people choose to disclose the full amount of their investments abroad. We are afraid there is a good deal of looseness in this regard—more so than there possibly can be with earned incomes, through the system of check returns that is now applied, by obtaining a return from the employer and one from the employed. The looseness over returns of investments abroad will continue with 1s. 4d. in the pound staring the investor in the face. We are pleased to see that during the discussion on the Budget, a concession was made to the small investor, by retaining 1s. 2d. as the tax on unearned incomes of £500 and under, and making it 1s. on incomes of £300 and under. In the gas industry, we have a considerable number of small investors.

Lighting of Poor-Law Institutions.

It is unfortunately a fact that workhouses and allied institutions are usually very extensive places; and therefore the question of their lighting is an important one, both for those who supply and those who have to pay for the illuminant. Reports of discussions, negotiations, and inquiries regarding this matter have frequently appeared in our pages; and a substantial further contribution will be found in this issue, in the account of the three days' Local Government Board inquiry into an application by the Islington Board of Guardians for sanction to a loan for the purpose of installing electricity in different buildings under their charge. The amount in question by itself was certainly not worth the spending of so much time over; but the loan is merely for installation—the annual charge is another, and more important, point. Besides this there were several questions of principle involved, as will be seen from the report, which, though long, is really hardly sufficiently so to bring out all the interesting points that were raised during the hearing. Those who read the account of the proceedings will be gratified at the evidence which it affords of the watchfulness of the Local Government Board and of the spirited policy of the Gas Light and Coke Company. The basis of the inquiry was an electric scheme prepared for the Guardians by Mr. J. Enright—whose name is not unknown to "JOURNAL" readers—with which, on first investigation, Mr. Ekin (the Inspector of the Local Government Board) was not fully satisfied; last week's hearing, for the further elucidation of the scheme, being the result. Pending the decision of the Board, it is, of course, impossible to say, and it would not be helpful to guess, what was the extent of the elucidation from Mr. Ekin's point of view. It may, however, be stated—and his warmest friends cannot quarrel with the assertion—that Mr. Enright proved a most bewildering witness. After giving his evidence on the first day, he was recalled on each of the two subsequent days, and heroic efforts were made, both by the Inspector and the Gas Company's Counsel, to get from him a plain statement of precisely what he proposed to do, how he intended to do it, and on what factors he had based his estimates and calculations. Not too much, surely, to ask of the gentleman responsible for the drawing-up of the scheme. As to the action of the Gas Light and Coke Company, in the position of large ratepayers, and as businesslike people, they have put up a big fight to retain an extensive customer; and the fame of this fight will extend beyond the walls of the offices of the Islington Board of Guardians.

Results from Municipal Undertakings.

In rapid succession now there are coming forward the results of the working of gas undertakings in the hands of local governing bodies for the financial year to March 31. The figures show the tremendous vitality of the industry, though balance-sheets have naturally been considerably affected by the high prices ruling for coal. In Birmingham, for instance, there is a slight reduction in the amount of the exceedingly handsome sum which is handed over in aid of the rates; but this decrease is more than accounted for by the increased cost of coal and oil. The consumption of gas grows in a most persistent manner. At Burton-on-Trent, also, the published figures again show increases in the quantity of gas sold for every purpose. The net profit is less; but the reduction is practically all accounted for by substantial concessions in the price of gas. Burton, it seems, is going to follow the lead of Stafford in inaugurating a profit-sharing scheme for municipal employees. This is a matter on which both the Corporation and the men are to be congratulated. A good year has been experienced at Nottingham; and while a large sum is to be handed over in relief of rates, a reduction in price is to be given to the ordinary consumers. A striking statement is made in the report, to the effect that the actual sale of gas per ton of coal carbonized is now over 2000 cubic feet in excess of the figures attained ten years ago. It is a regrettable feature that a big rise in the expenditure for coal has been accompanied by a substantial fall in receipts for residuals. Sales of gas are "up" considerably, as compared with the previous twelve months. The same remark applies to Rotherham, where, in spite of the increased cost of fuel, material, and wages, the surplus profit is practically the same as it was a year ago. Progress is reported from Stafford, where a nice little sum is set aside for the district fund in aid of the rates, and an amount representing 10½ per cent. on the wages paid has been allocated to the profit-sharing scheme in connection with the works.

Cost of Repairs.

The importance of a knowledge of mechanical engineering on gas-works to-day is too obvious to need any emphasizing; and the same remark applies to properly equipped shops on works where there is moving machinery. The paper which Mr. J. Edmondson recently read before the Manchester and District Junior Gas Association, and which was published in our columns last week, carries us, in an interesting manner, into this branch of work, from experiences derived at the Bradford Road station of the Manchester Corporation. We wish that more of the assistants on gas-works would publish special experiences with which they meet in this particular branch of work; for there must be a good deal of special experience about. There is only one point in Mr. Edmondson's paper which does not appear to have been directly referred to in the discussion. He alluded to the cost of repairing the machinery employed in connection with coal-gas plant, including air-compressing plant and stoking machinery right away to the purifiers. Some of the plant had been in use twenty-five years; and the cost averaged-out to 1·85d. per ton of coal carbonized in a year. Then the author gave figures for a carburetted water-gas plant as averaging 0·071d. per 1000 cubic feet. It would have been better if he had supplied the comparative figure at per 1000 cubic feet in the case of the coal-gas plant. Supposing 12,000 cubic feet per ton of coal carbonized were made, the 1·85d. per ton would then have been brought down to 0·154d. per 1000 cubic feet, which does not look so bad for the coal-gas plant, considering the age of much of it. If figures were given for the vertical retort plant at Manchester, they might show a still lower average for coal gas. But there is not much value in such relative figures unless one knows something as to the extent to which, and the pressure at which, the plants have been worked.

The "Electrician" and the Calorific Value of Gas.

The movement of the gas industry to secure a calorific value standard in place of the out-of-date standard founded on the luminous value of a gas-flame, has attracted the attention of a writer in the "Commercial Section" of the "Electrician;" and he —specially referring to the Gas Light and Coke Company's Bill now before Parliament—gives his readers some rather singular information. He says that "those who have studied the case will remember that, by the 'Metropolitan Gas Act of 1860,' the Gas Light and Coke Company were obliged to deliver gas which would give a certain candle power, while at the same time they were liable to penalties for delivering gas with less than a certain candle power." The title of the Act is not precisely correct; and though we have "studied the case" we are among those who do not "remember" that the Company have been under a dual standard and penal test for 54 years. The Company did not know it themselves; and they have been labouring under the impression that 1909 marked the year of their double manacling. Then we learn that the "true inwardness" of the present calorific

proposal (the difference between this and the one supposed to have been imposed in 1860 is not stated) has reference to cooking and heating; and the intelligence is given that the Gas Light Company "has been for some time, and must continue in the future, turning [*sic*] its attention more and more to the heating and cooking side of its business." Another interesting point is: "It [the Company] has already lost, and will continue to lose, a large portion of its lighting load; while, on the other hand, it sees a fair prospect of retaining for some time numerous consumers who are using electricity for lighting at present, but not for other purposes, owing to the latter's cost—real or supposed." Perhaps it will astonish our friend to learn that the gas business of the United Kingdom has more than doubled during the past twenty years, and that the quantity of gas sold is about equally divided between the hours of daylight and the hours of darkness. This shows that the loss to electricity for lighting purposes has been more than counterbalanced by new custom for lighting—notwithstanding the gas economy of the incandescent burner.

The Best Light for Railway Carriage Use.

Among the arguments advanced in the "JOURNAL" when the lighting of trains has been under discussion has been the one that the public ought not to be deprived of the best for their eyesight and the best for reliability, so long as it can be proved that the provision of that light is safe, or can by practicable means be rendered absolutely safe. Mr. Reginald N. Smith (late Clinical Assistant, Eye Department of the Westminster Hospital) may be claimed to be of the same way of thinking. Through the "Pall Mall Gazette" on Monday last week, he issued a warning to the public about reading in badly lit moving and vibrating trains or trams, together with an appeal to the Board of Trade and the Railway Companies for the better lighting of railway carriages, stations, and waiting-rooms. He proceeds to remark: "I have come to the conclusion that, if only one light is used in a compartment, the inverted incandescent mantle is the best. The light is soft, brilliant, and steady; but it must be of about 60-candle power to give good illumination in all parts of the compartment. The *next* suitable light is the electric; but there must be four lamps in each compartment—two on each side, and fixed below the luggage rack." Mr. Smith has evidently, by his observations, learned something about the high intrinsic brilliancy of the metallic filament electric-lamp, and has no doubt experienced the troublesome haze that there appears to be in a compartment lighted by electric-lamps, unless of high illuminating power, or unless (say) four sources of light are distributed in the compartment. With two electric lamps in certain trains running out of London, it is very difficult indeed to see to read—to say nothing of the variations in the illuminating power of the lamps during the stoppages and running of the trains. In view of the high intrinsic brilliancy of the electric lamps, we would rather not be sitting opposite those placed below the level of the rack, unless they were provided with shields.

Coal-Stove Makers on the Warpath.

Not long ago, the retail coal merchants were making a dead-set at the use of gas in place of coal for domestic cooking and heating, and were distributing very foolish statements concerning gas, which were easily disposed of, and some of which they would not have dared to connect-up with the gas supply of any particular company. The firm of Smith and Wellstood, Limited, have now joined forces with the coal merhants, which suggests that they, like the latter, have been hit by the popularity of a smokeless (therefore sootless) and dirtless system of cooking and heating in the household. Thus the sympathy between them and the coal merchants. We are surprised, however, that a firm of the standing of Smith and Wellstood should find it necessary to stupidly attack a competitor, and in an effeminate way, in order to try to stop the continued rise in popularity of gas cooking and heating. Their endeavour will be just about as successful as was dear old Canute in stopping the incoming waves on the seashore. The firm have prepared a leaflet which they are prepared to send in quantities to coal merchants, with name and address upon them, and without charge, to help them to "combat the increasing demand for gas-cookers"—the idea being that the coal merchants should issue the circulars with their accounts. The coal merchants must be very hard up for material if they think that a few futile statements such as are found in the leaflet are going to have any weight against the enormous experience that exists with gas-cookers and modern gas-fires.

The Firm's Trivialities.

The leaflet is in the main an advertisement for the "Wellstood Range;" and Smith and Wellstood—of course, quite as a secondary matter to the primary one of combating gas-cookers—hope that "incidentally" they may secure through the ironmongers "a few orders" for the range. Their modesty deserves the highest commendation. However, they think that the "arguments used on the leaflet are convincing, and may result in many of your [the coal merchants'] customers giving up the use of gas-cookers." We are sorry the firm hold such a good opinion of their senseless production, and such a poor one as to the mental capacity of those whom they intend shall be the recipients. We turn to the leaflet and find that when people, through a faulty kitchen range, are tempted to adopt gas-cookers (there are other reasons than a defective range that tempt people to use gas-cookers), "they have their food cooked in gas fumes, and incidentally run the risk of their cook being injured and the premises damaged should an accumulation of gas in the cooker accidentally explode." We wonder what Smith and Wellstood understand by "gas fumes," and what injury they think water vapour and pure carbonic acid can do to food. They know, as well as we do (if not they ought to do so), that there is nothing that is injurious to food about the products of the combustion of gas. The experience of millions of people, and in hotels, clubs, mansions, and so forth, and over many years, prove the contrary; and it is not therefore very creditable for the firm to insinuate something that is not true. As to explosions, there has been more damage done through kitchen boiler explosions than through the explosion of gas-cookers.

A Question of Waste.

Another point is this: "Remember," says the author of the circular, "that just as the mustard manufacturer makes a considerable part of his profit out of what is wasted, rather than out of what is consumed, so do the gas companies make a large profit out of the gas that is wasted in gas-cookers. A coal range when not actually cooking is always heating water." Nothing is said here about the labour of lighting and cleaning-up of coal ranges; nothing about the smoke, soot, and chimney sweeps; nothing about the contamination of the atmosphere by foul smoke and the products of the combustion of coal; nothing about the purchase and storage of coal by the householder; nothing about the stand-by costs between the preparation of meals; nothing about the maintenance of a great heat in the kitchen during the spring, summer, and autumn months when fires are not required. As to the point regarding the heating of water, well gas can do this when and as required, without wastefully heating up a large volume that is not needed. Is is largely due to labour-saving, to the ease of the regulation of oven temperatures, and to prompt work without waiting, that the gas-cooker has made its way and place in the service and economy of the community. Smith and Wellstood might give other people credit for possessing a certain amount of intelligence.

Masonic.—Evening Star Chapter.

The regular meeting of the Evening Star Chapter, No. 1719, was held last Wednesday at the Freemasons' Hall, Great Queen Street, London, when the Principals and Officers for the year 1914-15 were installed. In the course of the proceedings feeling reference was made to the death of E. Comp. Charles Meiklejohn, who held the Principal Chair during last year, and whose position in the Chapter was at the opening last week occupied by E. Comp. W. A. Surridge, I.P.Z. The officers of the Chapter for the current year are:

E. Comp.	J. W. Broadhead, P.Z. 61, P. Prov. Dep. G. Reg., W. York	M.E.Z.
"	" T. H. Adkins, P.Z., 889, Prov. G.S.B. Surrey	H.
"	" Frederick A. West, M.E.Z. 1602	J.
	" R. P. Normand	Scribe E.
	" W. Thomson	Scribe N.
"	" W. A. Surridge, P.Z., 1201, 1397	Treasurer.
	" Arthur E. Eves	P.S.
	" William Dommett	First A.S.
	" C. W. Offord	Second A.S.
	" A. E. Broadberry	Organist.
	" F. W. Cross, " Henry Kearns	Stewards.

A GRATIFYING RECOGNITION.

The Principles of Co-Partnership.

At the Annual General Meeting of the Société pour l'Etude de la Participation aux Bénéfices, held last week in Paris, under the presidency of M. Paul Delorme, formerly Minister of Commerce and Industry, the gold medal of the Goffinon prize was presented to Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company.

In making the presentation M. Delorme stated that the award was the outcome of a desire on the part of the Society to honour the zeal with which the principle and practice of co-partnership had been so successfully applied for many years past in the British gas industry.

In returning thanks, Mr. Carpenter said the receipt of such an honour at home would have been deeply appreciated by him. How much greater must the value of the gift be in his eyes as emanating from a country where Fraternity was not less honoured than Liberty herself? The two nations of Europe—indeed, of the world—who had led the van in the march towards Liberty were certainly those, long opponents, now united in an *entente cordiale*, France and Great Britain. If, however, these States were to reap the full benefits to which their passionate love of Liberty entitled them, then employer and employed in the industries which are so essential to the well-being of communities must arrive also at their *entente cordiale*. Mr. Carpenter expressed his firm conviction that only in co-partnership would a basis for this *entente* be found. In connection with the study of the subject, he paid tribute to the valuable "Guide Pratique" compiled by M. Albert Tombert, and to the "Compte Rendu" of the National Congress held in 1912 at Bordeaux, from which he was delighted to find how fully the views on co-partnership in the land of its origin coincided with those held at home. In conclusion, he begged his audience to believe that no honour bestowed upon him had afforded such intense pleasure as that which he had just received at the hands of the President of their Society.

PERSONAL.

In notifying last week Mr. T. H. Poulson's appointment at Stafford it should have been stated that he will be Works Superintendent (not Assistant-Engineer), in succession to his father, who was Works Foreman.

At a meeting of the Leek Urban District Council last Tuesday, Mr. R. H. Ginman (of the Birkenhead Gas-Works) was appointed Gas Engineer and Manager in place of Mr. S. T. Smith, who has gone to Malvern. There were 67 applicants for the position.

Mr. W. Rogerson, who is leaving Bollington to take up the position of Gas Engineer to the Middleton Corporation, has been presented by the members of the Bollington Urban District Council, the office staff, the workmen, and others residing in the locality with a handsome china cabinet, and some other appropriate gifts.

Mr. Charles Horobin, son of Mr. H. R. Horobin, of Warrington, has been appointed Chief Water Engineer to the City of Lincoln. Mr. Horobin served his apprenticeship in the Borough Water Engineer's office under the late Mr. James Deas. From there he went, in 1903, to Ipswich, as Assistant Water Engineer. In 1906 he took up a better position at Lincoln, and has now gained further promotion.

Great regret is felt at Exmouth that, owing to ill-health, Mr. J. T. Foster, the Secretary and Manager of the Exmouth Gas Company, has been forced to place his resignation with the Directors, after occupying the position for a period of 28 years. In this period, the business has developed from an insignificant concern to a high position among gas undertakings. When Mr. Foster entered on his present position, only two stokers and two yard labourers were employed; while to-day there is a staff of something like fifty.

It will doubtless be remembered that one of the visitors from America who attended the meeting of the Institution of Gas Engineers last year was Dr. Arthur H. Elliott, of New York. We learn that he will leave that city on the 5th prox. for Southampton, whence he will go to Leamington on a visit; and he hopes to be present at the annual meeting of the Institution, where, we are sure, he will be cordially received. After the meeting, it is his intention to visit Dresden, Vienna, and one or two other places on the Continent.

De Heer C. T. Salomons, Deputy Manager of the Rotterdam Gas-Works, and Editor of "Het Gas," is retiring after 38 years of municipal service. The greater part of this time he was Manager of the Feyenoord Gas-Works of the Rotterdam Corporation. Mr. Salomons, who is an honorary member of the Dutch Gas Association, is held in high esteem throughout the gas industry, and is well known to many of its members in England. He will leave Rotterdam and settle at The Hague. In his place de Heer de Bel, the Engineer of the works, is to be Deputy Gas Manager.

NOTES FROM WESTMINSTER.

For some sessions now we have not had in the Committee rooms such a plethora of discussion over gas measures as there has been during the past few weeks; and readers will not be sorry to see that some relief has commenced. During the past week, there has been very little movement in the gas line, though several Bills dealing with other matters have been under consideration. There will doubtless be more discussion as Bills move into the second House; but it is expected that it will only be of a spasmodic character. We have yet to learn the result of the opposition to the high-pressure meter clauses in the Bills of the Corporation of the City of London and the London County Council. There is opposition to these; it being considered that the time is not ripe for legislation in this regard, and, when there is legislation, that it should be applied to the whole country. It may be noted that the Chelmsford Gas Bill has passed the Unopposed Bills Committee of the House of Lords; but, by agreement, a purchase clause has been inserted, under which the Corporation are to give, within six months of the passing of the measure, notice of their intention to promote a purchasing Bill. The terms on which such a measure would be promoted, if sanctioned by the Corporation and ratepayers, include compensation to Directors and officers. As there is very little to talk about in connection with gas, a few notes on water measures may be given—these having been neglected during the time of extraordinary interest in connection with the Gas Bills.

Lighting of Courts—Annuities—Water Supply.

The section of the Local Legislation Committee over which Mr. W. Middlebrook is presiding has had a fairly heavy task to perform in considering the General Powers Bill of the Birmingham Corporation. Two or three of the clauses have interest for "Journal" readers. There was one relating to the lighting of courts, of which there are between 7000 and 8000 in the city. The Corporation regard it as an anomaly that they should be put to the expense of lighting these courts, seeing that they are in the nature of private streets. In the case of private streets, the Corporation light and extinguish the lamps; and the owners pay so much per lamp. The Corporation desired that the same arrangements should apply to the courts; but the Committee would not sanction this. Another clause asked for power to apply any money forming part of the sinking funds for gas and water annuities to the redemption of either class of annuities, instead of the money being specially applied to one or the other as at the present time. Certain annuitants protested against any change being made. But the Committee considered that the City of Birmingham was in a financial position to fully protect the annuitants; and they could not see that any harm would result from the change. The authorization was therefore granted. A further clause proposed that an owner of any house not provided with a proper water supply, who allowed the house to be occupied, should be liable to a penalty not exceeding £5, and to a daily penalty not exceeding £1. Provision was made to exempt any owners in respect of houses erected before the passing of the present Bill, as well as the owners of houses without a scullery, or any dwelling-house in respect of which there is no sewer or drain, and a water-main is not reasonably available. The Committee were willing for the clause to be applied to new property; and they also desired that it should apply to existing property, if the Corporation could see their way to bear part of the expense of making necessary alterations. The Corporation offered to bear one-third of the cost; and this was agreed to.

Glasgow's Rejected Water Scheme.

For several days Lord Ribblesdale's Committee have had before them the extensive scheme of the Glasgow Corporation for a new water supply from Loch Voil and Loch Doine, the expenditure upon which was estimated at £1,250,000. The two lochs are practically one lake; and, from the opening speech of Mr. Balfour Browne, K.C., it is gathered that the works proposed were the construction of a dam at the eastern end of Loch Voil, so as to raise the level of the water in the loch by 45 ft. 6 in.; the construction of a railway to make a connection with the Caledonian Railway line; the building of an aqueduct to convey the stored water from Loch Voil and Loch Doine to Loch Katrine, whence it would have been conveyed to Glasgow; and to construct a new and higher road in place of the existing one to the north of Loch Voil. It was in contemplation to purchase the whole of the watershed for the purpose of protecting the water supply. Three estates were affected by the scheme. With two of the owners, the Corporation effected settlements; with the third (Mr. Carnegie) they could not agree, and he strongly opposed the scheme. County councils and other authorities were also hostile to it—objecting to the invasion by Glasgow of the eastern watershed, and to interference with scenic beauty and historical associations. The Corporation, on the other hand, based their case on the more material ground of the water necessity of Glasgow. No use would be served by running over the cases *pro* and *con*, as the Committee, after the several days hearing, rejected the scheme. Lord Ribblesdale declined an invitation by Mr. Talbot, K.C., to state the grounds of their refusal, in order to guide the Corporation in considering the serious

problem with which they were confronted. Select Committee practice, and the possibility of future Committees being involved in an awkward position, were the reasons given by Lord Ribblesdale for refusing to accede to the invitation.

Water Charges at Bristol.

The Bill promoted by the Bristol Water Company has passed the Unopposed Bills Committee of the House of Lords. The Corporation had petitioned against the measure; but an agreement was effected. We understand that, at the instance of the Corporation, the additional capital is to be raised by the issue of preference shares or preference stock only—the maximum interest being limited to 5 per cent. per annum. Then after Dec. 21 next, in regard to water supplied for domestic purposes to any workhouse, asylum, or other public institution, the building is to be deemed a private dwelling-house. If the water for domestic or other purposes is supplied to any such building by meter, the charges are to be in accordance with the trade scale in the district, *plus* the rent of the meter. The arrangement may also be varied so that the supply for domestic purposes is in accordance with the former arrangement and the supply for other purposes by meter. Six months' previous notice is to be given in regard to the exercise of any of these options. There are clauses referring to the supply to out-districts. A further one provides that the occupier of a dwelling-house, or part of a dwelling-house used otherwise than as a private dwelling-house only, may require water to be supplied by meter at the rate of 2s. per 1000 gallons up to the sum which would be payable by such occupier if the supply were furnished on the rate payable for domestic purposes; any water supplied in excess of the quantity so determined to be paid for at the rate of 1s. 6d. per 1000 gallons. With these changes, the Bill proceeds.

Tees Valley Water.

The Tees Valley Water Board Bill was before Colonel Bathurst's Committee. Extended limits, additional works, and other purposes are of the component parts of the measure. The opposition came from riparian owners and the Darlington Corporation; and practically the whole force of the attack was made on section 12 of the measure. This was to the effect that the Board might enter into and carry out agreements with any local authority, firm, or person for the supply of water beyond the limits of the Act for such period and on such terms as might be agreed upon, provided it was not given except with the consent of any company or person supplying water under parliamentary authority within the area, and that it does not interfere with the domestic supply in the home districts. The promoters assured the Committee that although such powers were asked for, if they were allowed, they would not be abused. It transpired that the total amount of surplus water the Board would possess would be over 90 million gallons per week, which, it was contended, would leave ample margin for giving an increased supply to quarters beyond present clients. In the opinion of Mr. Hugh Wilson, the Manager to the Board, no one would be prejudicially affected by the proposals; and Mr. E. L. Mansergh saw no reason why the Board should not have power to sell their surplus water. The upshot of the discussion before the Committee was that they agreed to the passing of the preamble of the Bill; but Mr. Balfour Browne, K.C., was asked to submit later, for the consideration of the Committee, a clause limiting the outside supply, under section 12.

New Works and Hospital Accommodation.

The National Health Insurance Commissioners appear to be looking rather closely after the question of the provision of hospital accommodation when large reservoirs are under construction. This is no doubt proper; but they might, before intervening, consider what is actually being done in a specific case. The Abertillery and District Water Bill has been before the Unopposed Bills Committee of the House of Commons; the measure proposing the construction of a compensation reservoir below a reservoir now in course of construction. The Insurance Committee of Wales had asked the Local Government Board to secure the inclusion in the Bill of the model clauses relating to hospital accommodation. Mr. Arthur J. Lees, the Parliamentary Agent for the Bill, was able to assure the Unopposed Bills Committee that the promoters had done a great deal more than the model clause required. Seeing that the Standing Orders give the Committee discretion as to the insertion of model clauses, the Committee did not see, in view of the accommodation provided, that there was any necessity for inserting the model clause; and so the Bill was sent forward unamended. The incident shows how efficiently promoters of Private Bills are officially policed in these days.

Domestic Consumers First.

The Market Rasen Water Bill has been before Sir Edwin Cornwall's Committee—the objects of the measure being the construction of new works, additional capital, &c.; the capital asked for being £7500. The only petitioner against the Bill was Mr. C. D. T. d'Eyncourt, who owns the estate on which the spring exists which the Company seek to tap. His contention was that the Company could get additional water from the stream in Market Rasen where the extraction of water would be less injurious than if the water were taken from higher up above the mills. Mr. E. J. Silcock, Mr. Brough Taylor, and Mr. J. B. Ball, Engineer-in-Chief to the Great Central Railway, gave evidence in support of the Bill. The Committee, however, were solicitous for the domestic supply of the district, and decided that, while passing the preamble, a clause should be inserted in the Bill providing that the interests of the inhabitants should not be prejudiced by any undesirable bargain with the Railway Company, and that the supply would be given for the whole area before any increased supply was given to the Railway Company. There was a good deal of arguing over the matter; but eventually a clause was agreed to in the following terms: "From and after the construction of the works by this Act authorized, the Water Company shall not supply water for purposes other than domestic supply on any day on which there shall be in the reservoir by this Act authorized to be constructed at Hamilton Hill, less than 160,000 gallons of water."

Full Compensation.

The Earl of Lytton, who has been for years taking a share in Committee work on Private Bills, has been presiding this session over the one that had, among other measures, to consider the Bill of the Burgh of Motherwell, by which it was proposed to annexe the parish of Dalzell, which is at present administered by the County of Lanark, as well as confer powers of water supply over their whole administrative area, including the proposed extension. In the result, the enlargement of boundaries was refused; but the Committee gave the burgh the right to take control of the water supply over their whole existing area. They considered, however, that full compensation should be paid to the county for the loss of the undertaking in that area. According to Mr. Balfour Browne, K.C., the agreed compensation to be paid to the county is £37,500; and fifty years has been allowed by the Committee for repayment.

Weston-super-Mare Water.

The Weston-super-Mare District Council have satisfied the Earl of Plymouth's Committee that their new water scheme is both requisite and feasible, and will do no damage to anyone. The new works are estimated to cost £69,490; and the Council are desirous of assuring that the daily supply shall be equal to 1½ million gallons, instead of the present 1 million gallons. Between maximum and minimum water requirements, there is a wide difference in a popular seaside resort; and it is the summer need that for safety compels the Council to carry out the new scheme. There was heavy petitioning against the Bill from landowners and others; and a good array of Counsel and expert witnesses were engaged. A clause is to be inserted in the Bill ensuring that the minimum dry weather flow at Banwell is 1 million gallons; but no extra expense is to be placed on the Banwell villagers, who are also to have water for domestic and other purposes.

[Other water measures have been before Committees, and will be noticed in due course.]

A Big Electricity Scheme.

The Manchester Corporation, in their General Powers Bill (which has been before Lord Barnard's Committee), have obtained power to put up a large electrical generating station at Barton, the estimates for which amount to £1,200,000. They also sought to buy up the undertaking of the Electricity Company supplying the Trafford Park Estate, and to secure powers of supply in that area. But in this they met with a stout resistance on the part of the Stretford District Council, of whose area Trafford Park forms part, though the electricity supply is in the hands of the Company. The Stretford Council think that, if there is to be any transfer of the supply in that area, it should be to them. Lord Barnard's Committee were not prepared to allow Manchester to invade a territory that should by all natural laws belong to Stretford—if the Company now supplying are desirous of parting with their rights.

London and Southern Junior Association.—The annual general business meeting of the Association will be held next Friday evening. The balance-sheet will be presented, a report on the work of the Association during the past year will be made by the President (Mr. S. A. Carpenter), and the officers and Council for 1914-15 will be elected. During the evening a demonstration will be given of the "Pulmotor" automatic resuscitator.

Rating of Machinery.—We have received from the Secretary of the Manufacturers' Association, Limited (Mr. C. Charles Wells) a pamphlet bearing the above title which has been prepared for them by Mr. G. Humphreys-Davies, F.R.L.S., &c., and which they are publishing at their offices, No. 110, Cannon Street, E.C. Mr. Humphreys-Davies is the Consulting Surveyor to the Association, and his booklet is the outcome of a request for a concise and non-technical statement of the subject which would enable the manufacturer to form an approximate idea of the extent to which his interests are affected. The use of legal phraseology has consequently been avoided as far as possible. The author first gives a comparative statement of the law as to the rating of machinery in the three kingdoms, and then deals with its application in England. As he is the author of "The Principles of Rating" and of "The Value of Buildings and Machinery as Bankers' Security," and has had many years' experience in valuing properties of all kinds for rating purposes, his work may, we think, be relied upon for furnishing reliable information.

ELECTRICITY SUPPLY MEMORANDA.

THE "Point Fives" have been airing their views on the subjects of domestic electric cooking and water heating, at a meeting held at the electrically-operated Brompton and Kensington Restaurant, in the Earl's Court Road. An opening address, prepared by Mr. J. W. Hame, was read; and a discussion followed—paper and discussion showing that our electrical friends are still as far off as they were two or three years ago from settled convictions as to what is best in the matter of the design of electric-cookers for domestic use. Ruling conditions are obstinate factors for them to subordinate to the requirements of electricity for kitchen use. The low heating value of electricity is against them; the complications of construction are troublesome as soon as the eyes and attentions of electrical guardians are detached from the appliances; and kitchen habits and usage of utensils are not of the merciful character that the electrical forms demand. The standards of refinement and patience have got to be raised considerably among, and observed by, the elements composing the social structure before happiness will reign where there are electrical kitchen appliances in use. Meantime, the electricians are making ardent use of the few fanatics who have applied electrical operation in the kitchen, and the few restaurateurs who have adopted electric cooking as a novelty for advertising purposes. But the progress is not of a startling character. Influence and considerations other than practicability, ease, and reliability are the sole moving causes of the adoption that has yet been achieved. We know this because electric-cookers have been displaced by gas-cookers after experience; and mouths will open and disclose facts. Not long ago we heard of an electric-cooking outfit being on offer for a sum about one-fourth of its original cost; and one of the recommendations put forth was that it was "nearly new." The owners' willingness to effect an early disposal while the outfit was "nearly new" was not exactly a recommendation. However, about the "Point Fives" paper and discussion, there is a writer in "Electrical Industries" who contributes matter under the heading of "The Autocrat of the Board Table;" and he says, in a paragraph with "Amateur Cooks" as the side heading, that "after brooding over the proceedings at the last meeting of the 'Point Fives,' he is not certain whether to laugh or cry." The fact that he pokes fun at the discordant views of the "Point Fives" indicates that he was tickled, and did not weep, unless he laughed until he cried. The spectacle of these station engineers spreading abroad their contradictory views as to what is required in an electric-cooker, as though they were experts in the requirements of the kitchen, was really too much for him. But who, if not electrical engineers, are to discuss how to harmonize the hostile requirements of the kitchen with the physical disabilities of electricity for cooking?

"Point Fives" Discuss Electric Cooking.

However, we must leave the writer nursing those aching sides produced by the confused efforts of the "Point Fives;" and turn to the principal features of the discussion. There is discord as to whether heating elements in the electric-cooker should be situated at the top and bottom or at the sides. The "Point Fives," after all the experience they have had, are not yet at one on this point of location. The discussion suggests that the heating elements must be so placed that the heat plays direct on to the food to be cooked. If a piece of meat is hanging by a hook, then side heating is best. If the meat is in a tray, then top and bottom heating elements are preferable. If pastry is being cooked, then the beneficent heat should come from the top. Forsooth, electricity applied to the domestic oven is a very particular thing. Why not have movable elements, so that the user can please herself or himself as to the quarter whence the heat shall come? The more the electric-cooker is complicated, the better—from our point of view. Then, taking paper and discussion together, there is a divergence of opinion as to the advantages of windows in oven-doors, and thermometers in the ovens, for examining the perspiring viands and checking temperatures. Electric cooking is a very delicate operation. Some think the windows and thermometers are desirable; others (and these are the majority) do not. But it is generally accepted that oven-doors must not be opened, as the precious heat inside must be conserved. We have tried to penetrate the steamed and grease-covered windows after a joint has been perspiring inside, and have failed. As to the thermometers, we have carefully examined these much ill-treated things, and have marvelled how scientifically trained men could expect them to properly fulfil their function, especially those with a part exposed outside the oven. Several speakers during the discussion expressed the opinion that the thermometers are misleading; and they find, as the gas industry has found, that cooks prefer to rely on experience rather than go about their cooking in a manner that is more in consonance with laboratory than kitchen practice. Mary Ann cannot be expected to possess the attributes of a "F.I.C." Besides, these accessories to temperature regulation are opposed to the constant temperature theory lauded by some electrical engineers, who do not consider the overlapping effects when they change from full to three-quarter, half, or one-quarter heats, nor the effect of loss of heat from different forms of oven. The claims are all very silly. Mr. A. H. Seabrook expresses his views on the subject of constant temperature, when he proposes the automatic control by means of a thermostat, so as to do away with individual switching. He suggests that by means of a thermostat the cook would have to simply turn the pointer of an indicator to the temperature required; and all would be well. Mr. Nichols Moore, of Newport, pointed out that he has cookers on continuous and alternating currents; and he experiences trouble through pressure variations on continuous current circuits. Where is the courageous Grogan? Echo answers, Where? However, what is the good of talking of the standardization of electric-ovens when the distinguished members of the "Point Fives" Association are at variance as to requirements, and as to the best means of meeting the needs of the kitchen?

Laboratory Refinements in the Kitchen.

According to the elastic imaginations of some electrical men, there is no loss of heat from the electric-oven. Where the heat constantly discharged into the oven by the electrical energy goes to does not trouble them. There is no loss of heat, they say. The platform electric cooks of the feminine gender chirp, as they are taught to do, in the same cheerful manner. "Forgive us our trespasses" has no part or lot in their final nocturnal utterances. Mr. Gillott ["Gill" and "ott" form an admirable name for a man dealing with electrically derived temperatures] has been reading a paper before the Newcastle Section of the Institution of Electrical Engineers, and giving the members information as to the time taken to reach, with a certain consumption of energy, a given temperature, and as to the time occupied for the fleeting units to dissipate themselves, despite the heat-retaining character with which imagination—and imagination only—has endowed the ovens. A lagged oven, having a cubical capacity of 2110 inches, loaded to 1000 watts (the makers' rating being 2·2 kw.) arrived at a temperature of 450° Fahr. in a little over 30 minutes. The current was then switched off, and in 50 minutes, the temperature had fallen to 200° Fahr. Another lagged oven, with a capacity of 2141 cubic inches, loaded to 1836 watts (the makers' rating being 2·4 kw.), reached a temperature of 420° Fahr. in 50 minutes. On the current being switched off, the temperature fell to 200° Fahr. in 60 minutes. Then we come to an unlagged polished oven of the biscuit-tin type. This had a cubical capacity of 2496 inches. The loading was 1350 watts (250 watts less than the makers' rating). It took 50 minutes to reach a temperature of 400° Fahr.; and the temperature fell to 200° Fahr. in 35 minutes. In heat efficiency and in conservation of heat, the first lagged cooker thus came out best. But the second lagged oven was a fearful example of heat inefficiency; and the polished oven came in between in the matter of B.Th.U. expended in heating up, although the maximum temperature was 20° below that of the second lagged oven, and 50° below that of the first. But a strange thing is that, although its heating-up efficiency was higher, it showed the greatest alacrity in losing heat—reaching the 200° Fahr. level in 35 minutes, against 50 and 60 minutes in the other cases. The cookers with which these tests were made had been in use upwards of twelve months. The excuse made for these poor heating-up results is the local pressure fluctuations; the voltage being below the normal. Where is Grogan again—that self-appointed expert on the effects of gas-pressure fluctuations?

Oven Temperature Experiments.

Let us return to the "Point Fives" discussion. The inclusion of electric-lamps in the ovens, which soon get dimmed by the surrounding steam and grease saturated atmosphere created by the perspiring joint, is not generally advocated. They soon become useless, and quickly break-down. A window is no good without a lamp; a lamp is no good without a window; and neither is any real good with greased steam clouding from view the characteristics of the joint in the oven. Another point upon which there was less divergence of opinion is that there must be indicating devices to show when circuits are in use or otherwise. The trouble with the indentation of the bottoms of heating utensils was a further point; and utensils with cast-iron bottoms turned or ground flat were advocated. There must be perfect contact with the heating element, or there will be disaster. We commiserate with our electrical friends. Then there cropped up the question of developing the domestic load for purposes other than lighting; and this raised the point as to the best means of proceeding to accomplish it. The old-fashioned mode of the thin end of the wedge was favoured. Mr. Hame suggested the use of electricity for laundry work; and, though Mr. J. W. Beauchamp, of West Ham, does not think there is much room for domestic laundry electrical equipment in London, most of the other speakers considered that the electric-iron is one of the best possible introducers of the use of electricity for domestic purposes other than lighting. Mr. P. Rycroft favoured the giving away of electric-irons each year as a substitute for discount. It is considered by other electricians that this is sound policy, which shows that they see the wisdom of the gas industry's practice of affording more facilities to the consumers than in the olden days—the differences being that the affording of facilities does not cost the gas industry so much as the electrical industry, and that the gas industry is paid for gas at lighting rates. Other speakers favoured free trial of appliances as a sound policy. Incidentally the subject of hiring rates was raised; and it was recognized that, owing to the higher initial cost of electrical appliances, the gas industry

Sundry Points.

has an advantage. One speaker in this connection supported the action of Mr. Seabrook in lowering the rates of hire, and adding something to the price per unit for electricity used for cooking and heating purposes. Here, however, comes in the question of the amount of consumption providing a counterbalance to the reduction of hire. West Ham, for example, is not Marylebone.

Water Heating.

In the postprandial discussion by the "Point Fives," water heating by electricity came to the surface. It is a topic that cannot long be escaped or ignored by electricians. It is a drawback to electrical operation in the kitchen, as so much boiling work has to be done. To take the keen edge off the dissatisfaction of users of electrical cookers, one speaker thought the user of a hired-out oven ought to be supplied with a quick-boiling kettle, or with an "instantaneous" water-heater, fitted alongside the cooker, to provide a small trickle of boiling water. We have heard a lot about water heating by electricity in certain Marylebone conveniences; but there seems, from what our friend Mr. Seabrook says, to be a tremendous amount of trouble in getting the hot water at a reasonable cost. In the first place, he declares that, at one of the Marylebone conveniences, the cost of water heating, with current at ½d. per unit, comes out at rather less than *the previous gas cost*. Pray, what was the type of old-fashioned gas water-heater in use? We undertake to say Mr. Seabrook would not bring that electric-heater into competition, in respect of time, cost, or volume, with modern gas appliances for water heating. He also confessed they had tried a continuous electric-heater, with a thermostat controlling the accelerator for sudden demands. This came out a *great deal more expensive* than gas. Then they also tried a rather larger constant heat and no thermostat. This came out worse. Next they tried a thermostat alone, and no constant heat; the current being turned off at night when the convenience was closed, and switched on again in the morning—the thermostat keeping the water at the required temperature all day long. Turning to Mr. Gillott's paper, he has something to say on the subject of the poor heating efficiency of hot-plates or boiling discs, and their slowness of operation. A 6-inch disc, loaded to 820 watts, needed 40 minutes to reach a temperature of 500° Fahr. —the testing thermometer being placed ½ inch above the centre of the discs, and the temperature of the room being from 50° to 55° Fahr. A 7-inch disc, loaded to 805 watts, gave a better result. It reached 500° Fahr. in about 30 minutes. Other discs, 7½ and 8 inches in diameter, and loaded to 1014 and 1250 watts respectively, occupied 25 and 30 minutes to reach the same temperature. Using a 5½-inch cast-iron saucepan, starting all cold, with 2 pints of water raised to 170° Fahr., the efficiency averaged 45·8 per cent. It will be observed that the saucepan used did not cover the whole area of the disc; and mathematical precision in this regard is very necessary with the electric heating of water, in order not to lose a trace of the precious energy. Anyway, such an efficiency with expensive B.Th.U. does not spell economy.

M. O. H.

That wooden and unintelligent "Desk of a M.O.H." has, in "Sanitary Record," given further proof of its incapacity for judgment by congratulating itself upon having convinced us that the predominant constituent of ceiling plaster can have no purifying effect in a room and that a gas-flame cannot have any effect as an air sterilizer. Let us assure it that its congratulations are premature. In its jubilation over its false belief, it altogether forgets our challenge to produce some scientific information or argument, and some chemical proof, to show that Professor Lewes is wrong in what he has advanced. We hope that platitude does not satisfy the mental requirements of the readers of the emanations regarding gas lighting of the "Desk of M.O.H." Perhaps, however, platitude is only intended to amuse. If so, we apologize for having taken any notice of it. Anyway, it really was not worth the time and space.

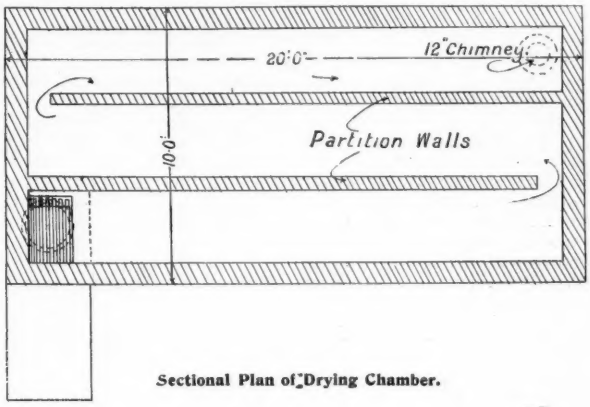
WORKS TOPICS.

By "Modus Operandi."

Drying Small Coke and Pan Breeze before Washing.

The method of drying small coke prior to the process of hand washing was briefly discussed in this column on p. 95 of the "Journal" for April 14, and was referred to by Mr. R. S. Ramsden, of Burton-on-Trent, in a letter in which he expressed a desire to hear more of the details of the arrangement. Unfortunately, the drying chamber was dismantled some years ago, owing to the installation of a mechanical breeze washer, and as there is no record of its construction, the accompanying sketch can only claim to show the general idea.

The effect of covering this heated area, which measured about 20 ft. by 10 ft., with a layer of small coke about 12 inches in thickness, was to evaporate off all the moisture in the coke, with the result that it became much lighter, and was thereby readily separated from the slate material and dross in the washing process. It must be remembered that the slate impurities found in so large a proportion in small coke absorb very little moisture, so that the drying process had little (if any) effect on their specific gravity. The same process would, of course, be equally effective in materially assisting the separation of pan breeze and clinkers. The large percentage of moisture in the former renders it very heavy; so much so that a portion of it is nearly as heavy as the lighter portions of clinker, which may often be found to be hollow in parts.



Sectional Plan of Drying Chamber.

Sectional Elevation.

The sketch here shown needs little, if any, explanation. A grate area of 3 square feet should be ample for heating a surface area of 200 square feet.

Metal Cutting by Gas.

The paper on "Mechanical Engineering in Gas-Works" read by Mr. S. Edmondson before the Manchester and District Junior Gas Association is quite a model of what such a paper should be. It is eminently practical throughout, and is deserving of close study by those responsible for the upkeep of plant in gas-works. It shows conclusively the need for the mechanical engineer in large gas-works—a subject which was discussed in this column some time ago.

A good deal is said in favour of the oxy-acetylene process of welding and cutting, both in the paper and in the discussion that followed. For welding, this process is very useful. But, as Mr. Edmondson pointed out, a number of firms lay themselves out to do this class of work; and it hardly pays to instal special plant for the purpose.

As regards the cutting of plates and joists, several speakers referred to the efficacy of using the oxy-acetylene blow-pipe for doing this work. Surely there was here a strange disregard of one of the well-known uses of town gas. Until I read the paper and discussion, I was under the impression that every up-to-date gas engineer in the country was aware of the great efficiency of the oxy-coal gas metal cutter. This useful apparatus, costing about £12, inclusive of flexible piping and pressure regulator, will cut any thickness of plate or joist equally as well as the oxy-acetylene cutter, and without necessitating any generating plant. Having had one in constant use for three or four years, and having in that time cut up many tons of material, it came as a surprise to me to learn that it was not in general use.

As an endorsement of the above remarks, the following is taken from the latest booklet on "Metal Cutting by Oxygen," issued by the British Oxygen Company: "For cutting new plates up to 1 inch thickness—or, in other words, for constructional rather than destructional work—oxy-coal gas cutters will be found to leave a cleaner cut than the similar oxy-acetylene cutter, although it is not quite so rapid in action." The makers recommend the use of oxy-acetylene cutters for rusty material, and for cuts exceeding 3 inches in thickness. This does not mean that the oxy-coal gas cutter is not capable of dealing with such material, but only that the other is more suited for this class of work.

Not only should these oxy-coal gas metal cutters be in regular use in gas-works, but should also be introduced to every possible user on the district. For demonstrating purposes alone, the purchase of the apparatus is warranted, apart from its usefulness on the works.

Gas in Operating-Rooms.—An inquiry was made through the medium of the "Question Box" of the American "Gas Institute News" as to whether there is any danger from the use of open gaslights in the operating-rooms of hospitals, owing to the possibility of the fumes of the ether which is used being ignited. The Bureau of Information of the Institute answered the inquiry as follows: "There is, of course, an element of danger in the possibility of ignition of ether vapours or fumes by open gaslights; but there are also many other conditions—such as the sparking caused by the closing or opening of electric switches, sparks caused by striking hard metal or other surfaces, alcohol lamp flames, open electric arc lamps, &c., which might easily be classed as an equal or greater hazard than the open gaslights."

NOTES FROM ABROAD.

Dutch Gas Association.

The forty-second general meeting of the Dutch Gas Association will be held at Flushing on July 14 and 15. The President of the Association this year is de Heer J. Blom, of Haarlem. Papers are to be read on "The Illumination of the Island of Walcheren," by de Heer van Niftrih, of Flushing; "The Use of Ferro-Concrete for Ammonia Tanks," by de Heer Blom; and "A New Inverted Burner of High Efficiency," by de Heer Snyders, of The Hague. Among the points to be raised from the question-box are: Breakdowns of exhauster plants; horizontal through-retorts of 12 feet length, and their results; the construction and handling of Guest-Gibbons stoking machinery, and its advantages as compared with the De Brouwer system; the action of heat on the membranes of automatic lighters; the use of gas coke in central-heating plants; standardization of house piping; and the relative advantages of a uniform selling price, a double tariff, and a differential system.

Train Lighting by Gas.

A report recently issued shows that in 1912 the State railways of Prussia and Hesse manufactured and used gas of various kinds to the extent of 25,001,549 cubic metres (883 million cubic feet), of which about 30 per cent. was coal gas. Of this, 13,444,578 cubic metres were used for the lighting of engines and carriages. The production of gas for their own use during the year showed an increase over 1911 of more than 3 per cent.

The Lighting of Rio de Janeiro.

Rio de Janeiro is said to be one of the most lavishly illuminated cities in the world. In 1912 over £300,000 was spent on public illumination both by gas and electricity; 7,918,660 cubic metres (279,655,400 cubic feet) of the former and 11,819,352,017 kilowatt hours of the latter being consumed. For private illumination in the same year 16,291,915 cubic metres (575,365,270 cubic feet) of gas and 11,653,036 kilowatt hours of the electric current were consumed.

Coal and the Price of Gas in Holland.

In several towns of Holland the new contracts for gas coals are based on lower coal prices. As a result of this, some towns have immediately lowered the price of gas to their consumers by half a cent per cubic metre (3d. per 1000 cubic feet).

Heavy Work for Accountants.

As a result of the compromise as to gas prices in Minneapolis, reported in the "JOURNAL" last week (p. 432), the Company have decided to employ six expert accountants for 30 days, who will examine some 60,000 consumers' accounts from last November onwards, with a view to ascertaining what amount is to be returned to overcharged consumers in accordance with the new arrangement. It is estimated that not less than $20,000 will be refunded in cash.

A Home for the Dutch Gas Association.

On the 1st of May the Dutch Gas Association became the proud possessors of a central office. Its full name is "Centraal Bureau der Vereeniging van Gasfabrikanten in Nederland" (the Dutch like long names), and it is situated at The Hague, van Beverninckstraat, 164. The new home of the Association is managed by an official who is not only to act as professional secretary of the Association, but also to be editor of "Het Gas" and of the Statistical Review of Dutch Gas-Works. His duties are therefore not light.

Water Gas in Steel-Works.

The "Iron and Coal Trades Review" reports some interesting and successful results of the use of water gas in the steel-works of the Torgauer Company, Germany. The gas, which is used for a 15-ton basic furnace producing steel for casting, is produced in Dellwik-Fleischer plant—there being two producers of 26,500 to 35,300 cubic feet per hour capacity. The working of the plant is supervised by one man with the assistance of a labourer. Blast-furnace coke is generally used, but gas-works coke is found to give almost as good results. The gas consumption averages 460 cubic feet per minute.

A Minimum Monthly Charge for Gas.

The New Jersey Public Utility Commission recently authorized a gas company under its control to charge a minimum monthly rate of $1 to all consumers. The price in the district is $1·50 per 1000 cubic feet. The company contended that there should be a minimum charge, as sufficient plant has to be maintained all the year round to meet the maximum consumption, which, it appears, is exceptionally heavy in the summer months. It seems a curious idea that the small, and presumably poorer, consumers should be expected to pay for this; but the Commission evidently considered it just.

Differential Gas Rates.

The question of the right of a gas company to allow special rates to certain consumers is now being settled by the Ohio Utilities Commission. A laundry owner recently complained that, though he used the same amount of gas as a certain foundry, the foundry obtained its gas at a lower price. The Commission decided that, as the lower price for the foundry depended on the quantity of gas used, all consumers of that quantity were entitled to the same treatment. The Mansfield Gas Company, however, was not content with this verdict, and appealed for another hearing of the case. The final decision of the Commission is awaited with interest.

Artificial v. Natural Gas.

A big action for damages has been brought by the Buffalo Gas Company against the Iroquois Natural Gas Company, in which the former Company claims $300,000 (£62,500) for injury due to its business by what is asserted to be a violation of the Iroquois Company's franchise. At the same time an injunction is sought to prevent the latter concern selling its gas for lighting purposes. The Iroquois natural gas is sold at 70 c. (nearly 3s.) cheaper than the artificial gas of the other Company, and the defendants allege that they cannot be responsible for the use to which the gas is put, once it is delivered to consumers. Should the injunction be granted, some 30,000 consumers of natural gas will have to give it up.

German Benzol Association.

The report of the German Benzol Association for 1913 has recently been issued. The market for 90 per cent. benzol was very favourable during the whole year, and in spite of an increase in home manufacture of nearly 40 per cent., the Association was even in arrears with delivery at times. During the year, 36,752 tons were sold to dye and colour works, 17,242 tons exported, and 57,839 tons sold in small quantities—a total of 111,833 tons, as against 84,460 tons in 1912. The sale of benzol for motor spirit amounted to 17,700 tons in the year under review, as against only 6200 tons in 1912. So that the Association hopes for still further development of this profitable branch. The market for toluol was quite satisfactory; but the demand for solvent naphtha and xylol did not keep pace with the supply.

An American Gas Advertising Campaign.

The May "Bulletin" of the American Commercial Gas Association announces that the plans of the Committee for national gas advertising, as announced recently in the "JOURNAL," are nearly complete, and that practically the whole of the money required has been collected. The subscriptions are on the basis of one-tenth of 1 per cent. of the gross sales of gas computed, for the first year's subscription, upon the year 1913. Those who have concentrated their efforts upon bringing the advertising plan to a point where it is about to be a reality, feel sure that the results will more than justify every company becoming a subscriber. It is expected that they will be direct and immediate; and the favourable sentiment which will be engendered from such a campaign will be of far-reaching benefit to the entire gas industry.

IMPROVED PUBLIC LIGHTING IN LONDON.

Centrally Suspended High-Power Low-Pressure Gas-Lamps in the City.

FOR many years centrally suspended high-pressure gas-lamps have been known in the City of London; and it again remains for the City authorities, as they were the pioneers in high-pressure gas lighting on both standards and by central suspension, to lead in hanging high-power low-pressure lamps across the thoroughfares. Such an installation has just been completed in Golden Lane, Cripplegate, which thoroughfare, it may be mentioned, was the first to be experimentally lighted by the Chartered Gas Company in July, 1807; the Company having lighted this street by the "Emperor" low-pressure lamps, each of 1000-candle power, in connection with their new scheme of lighting for the City. The lamps are about 20 feet above the centre of the roadway, compared with 27 feet, the highest of the 2000-candle high-pressure gas-lamps so hung. The suspension gear, with the raising and lowering apparatus attached to the house fronts, is in all respects similar to that employed in connection with the high-pressure gas lighting, and is by the James Keith and Blackman Company, Limited, who have installed it. The apparatus consists of a double self-contained winch with a separate gas-control box; the lamps being suspended on single wires. Each lamp has six burners, with a bye-pass, and gas and air adjusters on the outside; and the lamps burn at the ordinary district pressure. Up to the present, they have given satisfaction, and are very effective—being fixed at the intersections of streets. The work has been carried out under the superintendence of Mr. W. J. Liberty, the City Lighting Inspector.

When referring last week to the marriage of the younger daughter of Mr. Frank C. Taylor, the Manager of the Shanklin Gas-Works, it might have been added that, among the numerous handsome and useful presents to the bride and bridegroom, were a canteen of cutlery and silver plate from the Directors of the Gas Company, a silver-mounted cut-glass salad bowl and servers, with an illuminated address, from the employees, and a silver afternoon tea service from Mr. E. W. Drew, the London Auditor of the Company. The wedding cake was a notable creation. The base was in the form of a gasholder, while the panels surrounding the second tier represented various views in the gas-works—the ingenuity displayed in its construction being characteristic of the local firm who supplied it.

GAS-COOKER EFFICIENCIES.

Good Results from Deferred Investigation Work by the Davis Gas-Stove Company.

It was in July, 1912, that a special visit was paid to the Luton Works of the Davis Gas-Stove Company, Limited, for the purpose of making an investigation of the "Shadowgraph" system for the testing of gas-fires for hygienic efficiency; and the article resulting from that visit was the cause of creating such disturbance in a critical mind that an attack led to a great controversy, which has luxuriantly borne what at one time were "rare and refreshing fruits" in the shape of well-behaved hygienic gas-fires. That is a thing of the past; but the good resulting work continues. The point that occupies us now is the question of gas-cooker efficiencies; and the reference that has been made to the Luton visit in 1912, in connection with the "Shadowgraph" test, is due to a desire, in view of recent gas-cooker developments, to perform a little act of fairness to the Davis Gas-Stove Company in this direction. In development work, gas-stove makers are not immune from the very human desire to lead, and not to be copyists. It should therefore be placed on record that in July, 1912, it was our pleasure to see, and to examine, in an experimental stage a gas-cooker upon which the Company had then for some time been working in the endeavour to reach higher efficiencies. The work at that period was in a promising stage. But then came the "Shadowgraph" test; busy days of demonstration, of research, and of controversy; and great activity in the foundry and shops of the firm. The result of all this was that the work on gas-cookers with the view of raising their efficiency was set aside for a period, with the intention of resumption at a more convenient season. The controversy regarding hygienic efficiency having died-down, and the new standard in this respect having received such wide (and still increasing) adoption, the firm have once again taken up the question of raising gas-cooker efficiencies; and we are able to-day, as a result of personal inspection and temperature tests, to report progress.

The gas-cookers (we can now speak of them in the plural) are still in the experimental state, and the firm are not going to hurry matters forward for the present cooker season; inasmuch as, the further experiment and trial of new ideas are carried, the clearer becomes the evidence that what has already been accomplished is not final. The inspection of the experimental stoves was, of course, in confidence; and therefore the lines as to how the improvements have been effected cannot yet be explained—in fact, it would be useless to describe them, as the ultimate forms may show that what we have now seen has been superseded in some particulars.

For purposes of comparison oven temperature and consumption tests were made in the laboratories—first of all, with one of the No. 110 "New Davis" cookers of standard pattern. The oven of this cooker has a cubical capacity of 3·85 cubic feet; and during the observations, tests of the calorific value were made, and the room temperature and other data recorded—the oven temperatures being obtained by means of thermometers passing through holes drilled at suitable points in the oven door. The results obtained with the ovens have all been calculated (so as to give an efficiency factor) by means of a formula which allows for variations in calorific value, room temperature, oven dimensions, &c. The formula is as follows:—

$$\frac{V \times (T_1 - T_2) \times 1000}{G \times C} = \text{Efficiency factor.}$$

When

V = Cubical capacity of oven, in feet.
T_1 = Temperature of oven, in degrees Fahr.
T_2 = Temperature of testing room, in degrees Fahr.
G = Corrected gas rate, cubic feet per hour.
C = Calorific value per cubic foot of gas.

In the case of the standard No. 110 "Davis" gas-cooker, with an hourly gas rate of 11·25 cubic feet, an oven temperature of 372° Fahr. was maintained; and the efficiency factor was found to be 199·46.

The next oven tested was of exactly similar dimensions to the No. 110 cooker, in which an oven temperature of 384° Fahr. was maintained with an hourly consumption of 7·75 cubic feet of gas. The efficiency factor obtained was 300·9—an increase of no less than 50·85 per cent. This improved result is largely due to an ingenious device for automatically regulating the volume and direction of the secondary air supply to the oven; and we feel sure the importance of a saving of 3·5 cubic feet per hour to maintain a rise of 12° Fahr. greater than a standard cooker, is a marked and valuable improvement, which will be appreciated by all concerned.

A third oven was next tested, having a cubical content of 3·403 cubic feet, which was maintained at a temperature of 396° Fahr. with an hourly consumption of 8 cubic feet of gas, for which an efficiency factor of 267·1 was obtained, or 33·93 per cent. greater than with the standard cooker oven. This oven is built upon entirely new principles, and should we think result in a highly efficient oven of light but durable construction.

Turning from the oven to the hot-plate. Work on the griller is in hand; but no tests of this were made.

Taking the standard No. 110, the boiling burners were first tested; and an average efficiency of 37·1 per cent, was obtained. But on testing the improved pattern boiling burners, the efficiency was found to average 42·7 per cent.—an average increase of 5·6 per cent. But the rings are of greater capacity, which is clearly indicated in the tabulated results given. Work, however, in this direction is not completed; and the technical staff of the Company confidently anticipate further decided improvements.

Table I.—*Oven Tests.*

Stove Tested.	Oven Capacity.	Oven Temperature Maintained.	Hourly Gas Rate.	Efficiency Factor.	Comparisons per Cent.
No. 110—Standard	3·85	372	11·25	199·46	100·00
,, —Improved	3·85	384	7·75	300·90	150·85
New Construction .	3·40	396	8·00	267·14	133·93

Table II.—*Boiling-Ring Tests.*

Ring Tested.	Standard Type.		Improved Type.		Increase Obtained.	
	Efficiency.	Capacity.	Efficiency.	Capacity.	Efficiency.	Capacity.
	Per Cent	B.Th.U.	Per Cent.	B.Th.U.	Per Cent.	Per Cent.
No. 1 .	37·1	1485	42·1	2696	+ 5·0	+ 32
,, 2 .	37·9	2985	42·16	3165	+ 4·26	+ 10
,, 3 .	36·3	1372	42·7	1824	+ 6·4	+ 33

All this work is to the good for the gas industry and the producing firm; and we are satisfied, from what has been seen here and elsewhere that the gas-cooker of the future—though the current good types are not costly in their running—is going to be still more economical than its predecessor, through a more serviceable use, and therefore less waste, of the heat of the gas consumed.

THE QUALITY OF LONDON GAS.

First Quarter of the Year.

We give below, in the customary form, tables summarizing the results of the testings, carried out in the testing places controlled by the London County Council, of the gas supplied by the three Metropolitan Companies during the first quarter of this year, and, for comparison, the figures for the corresponding quarter of the two previous years. The period taken as the first quarter of this year is the thirteen weeks ended March 28. The figures become specially interesting at the present time, in view of the proceedings in the Committee Rooms on the Gas Light and Coke Company's Bill and other Bills, in which a calorific power standard is being substituted for a standard of illuminating power.

Illuminating Power.

Table I. gives the average of the results of testings of illuminating power both with the No. 2 "Metropolitan" argand burner and with the prescribed flat-flame burner. It will be seen that there is no substantial alteration in the illuminating power of the gas supplied by the Gas Light and Coke and the South Metropolitan Gas Companies, as compared with the corresponding quarter of the previous two years; but there is a slight fall in the illuminating power of the gas supplied by the Commercial Gas Company.

Table I.—*Averages of All the Testings of Illuminating Power for the First Quarter of the Year* [*Candles*].

Company.	No 2 "Metropolitan" Argand.			Flat-Flame.		
	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke.	14·60	14·38	14·36	8·20	8·05	7·84
South Metropolitan.	15·48	15·38	15·49	9·45	9·17	9·28
Commercial . . .	14·81	14·80	14·46	8·28	8·51	7·73

The lowest return for the argand burner from any of the testing places for the Gas Light and Coke Company was 13·31 candles, and in three weeks besides that in which this return occurred this Company had returns below 13½ candles. In only one week of the quarter was the minimum for this Company above 14 candles. There was a minimum return, in one week, for the South Metropolitan Company's gas of 13·79 candles; but in all other weeks the minimum was above 14 candles. The minimum return for the Commercial Gas Company was 13·49 candles, and in three weeks besides that in which this return occurred the minimum reported was between 13½ and 14 candles. The minimum returns for the flat-flame testings were 6·15 candles for the Gas Light and Coke Company, 8·06 candles for the South Metropolitan Company, and 6·94 candles for the Commercial Company.

Owing to the operation of the three days' average, it is impossible to say from the data given in the weekly returns issued by the London County Council whether the Gas Light and Coke Company may have been liable to incur forfeitures during the quarter in respect of returns below 13½ candles. The South Metropolitan Company were well above the forfeiture limit on all occasions; and the Commercial Company's deficit on one occasion of

0·01 candle will almost certainly have been counterbalanced by higher returns on the preceding and following days.

According to the provisions of the Gas Light and Coke Company's Bill in the present session of Parliament, the argand testings will cease to be carried out on the Company's gas; but the flat-flame testings may be continued merely for information.

Calorific Power.

Table II. gives a summary of the results of the testings of calorific power during the first quarter of the year and the preceding two years. There is nothing in the averages of the testings which calls for comment; and the minimum results of the net calorific power for the quarter are, in the case of all three Companies, above the limit of 112½ calories below which, on the average of three days' testing, the gas supplied by the Gas Light and Coke Company must not fall. The minimum gross return

Table II.—*Summary of Testings of Calorific Power (Gross and Net) for the First Quarter of the Year [Calories per Cubic Foot].*

Company.	Average.			Maximum.			Minimum.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke—									
Gross	135·1	135·3	136·4	148·6	147·6	148·4	124·0	127·5	122·8
Net	120·5	120·4	121·5	132·8	130·6	133·3	112·2	113·7	115·0
South Metropolitan—									
Gross	143·2	144·3	142·5	153·9	158·1	157·1	132·4	135·4	134·4
Net	127·5	128·4	126·7	138·3	139·9	140·0	118·6	120·5	119·1
Commercial—									
Gross	136·7	135·9	135·4	145·5	146·5	147·1	122·0	126·0	124·6
Net	122·3	121·4	121·2	130·6	131·8	132·8	115·3	111·6	112·7

for the Gas Light and Coke Company was 122·8 calories, which is equivalent to 487·3 B.Th.U. This is 12·2 B.Th.U. below the standard of 499½ B.Th.U. which the Company will be required to conform to under their Bill of this year, as approved by the Committee of the House of Lords. It is evident, therefore, that, on the working of the past quarter, the Committee have fixed on a standard which is somewhat high for this Company.

Sulphur.

Table III. gives the average and maximum figures for sulphur testings during the quarter. The noteworthy feature of the returns is the remarkable fall in the average proportion of sulphur in the coal gas supplied by the South Metropolitan Gas Company.

Table III.—*Summary of Testings of the Sulphur in London Gas for the First Quarter of the Year [Grains per 100 Cubic Feet].*

Company.	Average.			Maximum.		
	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke.	32·9	36·5	34·8	49·7	55·0	52·2
South Metropolitan	23·4	24·8	17·9	47·5	47·0	44·4
Commercial . . .	25·3	26·9	28·9	43·3	49·0	50·7

During the past quarter the sulphur in this Company's gas has averaged only 17·9 grains per 100 cubic feet, which is a figure reminiscent of the days when the whole of the gas was purified by lime. The past quarter's result clearly points to further extension by the Company of the use of the Evans' process of sulphur extraction.

AN UNFORTUNATE EXPERIMENT IN INCLINED CHAMBER RETORTS.

The town of Maastricht recently erected a new gas-works, and the gas-producing plant, consisting of inclined chamber retorts of small capacity, was built by Messrs. Aug. Klönne, of Dortmund. These chamber retorts are a combination of Coze ovens and chamber ovens; the only practical difference from the latter type being that instead of one chamber there are two rectangular inclined retorts placed one above the other. One oven has ten retorts, 15 feet by 1 foot by 2½ feet deep. The charge was calculated at 12½ cwt. per retort, to be carbonized in 12 hours; each oven thus producing 140,000 cubic feet of gas in 24 hours, or 11,380 cubic feet per ton of coal. The contractors guaranteed for the gas production from good and dry Westphalian coals an average calorific power of 5200-5400 calories per cubic metre gross (580-600 B.Th.U. per cubic foot), measured at 15° C. and normal barometer, and for the heating of the retorts a consumption of coke in the producers amounting to 340 lbs. per ton of coal carbonized; the coal containing no more than 6 per cent. of ash. As compared with other systems, the cost of erecting this plant was very low. To this were supposed to be added the following advantages: 1. Absence of charging or drawing machinery, as in filling-up and emptying the retorts gravity was the principal factor. 2. Long distillation periods, with consequent reduction of labour costs. 3. Cheap coal and coke conveying plant, owing to the relatively small weight of the charge.

All these theoretical advantages did not materialize in practice. In the ascension-pipes fitted on the upper mouthpieces of the retorts, the almost total condensation of the tar caused a continuous back-flow of tar to the retorts, so that the upper end of the retort was considerably lowered in temperature, and the whole carbonizing process was disturbed. An amelioration of this condition was attained by shortening the ascension pipes as much as possible, and afterwards thoroughly insulating the short tubes. The retorts have an inclination of 35°; and it proved impossible to charge in the same manner as with Coze retorts. The coal, and especially the smalls, settled at an angle of 45°, so that the lower part of the retort remained almost empty. All efforts to find a remedy for this proved without success, and so not only was the guaranteed and contracted gas production of 140,000 cubic feet per 24 hours far from being attained, but also the charge wanted 16 hours instead of 12 hours for complete carbonization. Moreover, the consumption of coke in the producers was much higher than the guaranteed figures. Needless to say, the Maastricht Corporation did not accept this new carbonizing plant, and finally invited the contracting firm to reconstruct the plant completely in such a manner as to conform to the contract terms, or else break down the ovens and take the bricks with them back to Germany. After lengthy negotiations Messrs. Klönne have decided to scrap the plant of small chamber retorts, and in its place to erect a new installation of large horizontal chamber ovens of a total daily capacity of 7,000,000 cubic feet—an increase in capacity of 25 per cent. The difference in the cost of construction between this new plant and the rejected plant, which is to be totally demolished, will be paid by the gas-works.

COAL STORAGE AND GAS MANUFACTURE.

In the year 1910 the Düsseldorf Gas-Works took quantities of coal, consisting of 150 tons each, from a well-known colliery of the Westphalian Coal Syndicate, and stored one part in the open in a heap 11 ft. 6 in. high, while the other 150 tons was piled nearly 10 feet high in a shed, with normal storage conditions prevailing as far as possible in other respects. In July and August last year —*i.e.*, 3½ years later—10 tons of each of these separately stored coals were sent to the Experimental Institute of the German Association at Karlsruhe, and distilled separately for purposes of comparison; special care being taken that similar conditions prevailed in each case. Dr. Karl Bunte communicated the results of these interesting experiments in the last number of the "Journal für Gasbeleuchtung." As the figures are for comparison only, they have not been converted from metric to English standards.

	Stored in Shed.	Stored in the Open.
Composition of Coal.		
Ash	10·61	11·11
Moisture { Total	0·21	5·46
Moisture { Up to 110° C. . . .	2·26	1·34
Pure carbon substance	86·92	82·09
Carbonizing Results.		
Oven temperature	1185° C.	1180° C.
Gas production (N.T.P.)	33·9 cubic metres	33·9 cubic metres
Coke	71·9 kg.	71·9 kg.
Tar	3·8 ,,	4·4 ,,
Crude liquor	6·9 ,,	8·4 ,,
Gross calorific value	5275 calories	5250 calories
NH_3 per 100 kg. of coal	275·7 grammes	269·0 grammes
Coke.		
Quite fine dust	19 per cent.	32 per cent.
After a fall of 11 feet :		
Size—Over 45 mm.	48 per cent.	34·5 per cent.
,, ,, 30 ,, ...	25·7 ,, ,,	22·9 ,, ,,
,, ,, 5 ,, ...	19·3 ,, ,,	31·3 ,, ,,
,, Under 5 ,, ...	7·0 ,, ,,	11·3 ,, ,,

Even if no general conclusions as to the effect of storage on coal can be arrived at from these tests, it is interesting to note that, at any rate in the case of this particular coal, there is no material change in the gas production and the calorific value of the gas produced. However, the coke obtained from the open-stored coal is considerably inferior to that from the other. Moreover, the results are practically equal all through, except in the case of the gas liquor, which is explained by the difference in moisture content of the two coals.

Dr. Bunte announces that further experiments are being made, with the help of another large gas-works, on the effect on coal of storage, especially with a view to comparing stored with freshly mined coal. The results of these researches will be published at a later date.

Modern Water Supply.—From the publishers, Messrs. R. Oldenbourg, of Munich and Berlin, we have received a book entitled "Modern Water Supply in Thickly Populated Districts of Germany." The author of the work is Dr. A. Heilmann, and it purports to be an "economic and technical" review of the subject. The price, in paper cover, is Mk. 5,50, with 21 illustrations and 2 folding plates. A fuller account of the work will be given in a later issue of the "Journal."

COKE FUEL FOR METROPOLITAN MOTOR BUSES.

An interesting development in the motor industry has to be recorded, which promises very considerable possibilities for extending the use of coke fuel for steam-raising.

Faced with the increasing cost of petrol, makers and users of commercial motor vehicles will welcome the advent of the coke motor which has now been proved fully equal in handiness and reliability to the petrol motor, while the fuel costs are said to be equivalent to petrol at 4d. per gallon, or 12 ton-miles for 1d. The estimated annual coke consumption of a motor bus operating on this system is 100 tons.

Mr. Thomas Clarkson, M.Inst.C.E., Managing-Director of the National Steam Car Company (which has operated the well-known white steam buses in London for many years) has been successful in adapting one of his existing chassis and its water-tube boiler (the latter hitherto using paraffin oil fuel) to the use of graded coke fuel exclusively; and we are now enabled, by his courtesy, to give the following description and details of trial runs.

Enough graded coke for a 50-mile run at full load is stored in the bunkers around the boiler, where, to some extent, it is pre-heated by the heat radiated through the boiler lagging. The bunkers are provided with hopper bottoms, and automatically feed the coke on to the rocking fire-grate. The products of combustion are drawn from the "smoke-box" by means of a specially adapted steam exhauster, and are discharged through a dust-catcher and cooler on to the road surface. It is gratifying to know that this arrangement has already been so far perfected as to satisfy the very strenuous conditions imposed by the Metropolitan Police authorities. The induced draught system under which the coke fuel is consumed is practically inaudible in operation. In the accompanying photograph, a standard motor bus chassis is shown fitted with a lorry body. The absence of the usual chimney and the similarity in appearance to a petrol lorry will be noted.

The following details of trial runs may be of interest:

Distance travelled without clinkering .	105 miles
Non-stop runs accomplished	50 ,,
Average miles per hour on non-stop runs	17 ,,
Total weight of chassis and load . .	6 tons
Fuel cost per car mile	0·4d. (coke at 19s. per ton)
Average steam pressure	250 lbs.
Average steam temperature	650° Fahr. (superheated)
Average feed temperature	350° Fahr.

In thus developing the details of the coke-burning equipment, Mr. Clarkson has throughout had the active co-operation of the London Coke Committee.

[*Photo: Percy F. Coggin, Twickenham.*

PETROL AIR-GAS AND THE LIGHTING OF WORKHOUSES.

Some Figures from the Romford Guardians' Agenda Papers.

For some time past, the petrol air-gas plant firms have been exploiting workhouses, and have been endeavouring to show considerable savings by the use of their plant compared with coal gas for lighting purposes. But the information given, which appears satisfactory to some Guardians who are laymen in the matter, is quite devoid of such considerations as the actual quantity of illumination afforded for a given price, based upon the current cost of petrol. Various other items of expenditure which should come into calculation are also conspicuous by their absence.

In any general consideration of the subject, we may take it that inverted burners for coal gas lighting are somewhat cheaper than those for petrol air-gas lighting, but that mantles and glasses will cost about the same amount of money. But with this expense for burners, mantles, and glassware, the costs of the coal-gas consumer end—other than his bill for gas. Not so with a petrol air-gas user. His expenditure includes the capital cost of the plant; and for this he has to provide for depreciation at the rate of (say) seven-and-a-half years' repayment. But expenditure on petrol (which is an uncertain quantity from year to year) and depreciation of plant are not the only costs. There are current repairs to be met; and, whereas coal gas is delivered right up to the point of use without incidental expenses or trouble to the user, the petrol air-gas plant requires attendance, which also costs money. The trouble involved must therefore be greater right away from the purchase of the petrol, its storage, attention to plant, repair, and so on up to the burners. Most people, we think, would prefer to be free in their daily existence from the additional worry attaching to a plant of the kind, and would be prepared to pay a little more for coal gas, even if it were true (which it is not) that it does cost more with equality of light and periods of use. The actual relative costs per hour per 100-candle light for petrol air-gas and coal gas can be obtained from the contribution of Mr. W. J. A. Butterfield, M.A., F.I.C., Assoc.Inst.C.E., to "Competition Points for Gas Salesmen" (pp. 68-69).

In placing the advantages of petrol air-gas lighting before boards of guardians, the results obtained at the workhouse, infirmary, and offices under the control of the Romford Guardians have been so frequently referred to by the makers of petrol air-gas plant that we have tried to obtain some of the details of their experience, but have failed, except in regard to the very general, inconclusive, and detail-obscuring ones appearing in the *agenda* papers prepared for the meetings of the Guardians, and copies of which, we found, were open to inspection at a certain public place. Ever since 1908, the Romford Guardians have been smitten by the petrol air-gas system; and in some new buildings, after obtaining quotations from various sources, they had a trial plant put in by Machine Gas Limited (Cox's system), and for which plant the Guardians subsequently agreed to pay £96 10s. 6d. Between that time and 1912, the Board were very restless regarding the lighting of the old building. They tried to get better terms from the Romford Gas Company, who were willing to come down in price from 3s. 3d. to 3s. per 1000 cubic feet (less 10 per cent. on payment of the account) providing the Guardians would give them the whole of the lighting of the buildings—old and new. The Guardians tried to obtain still better terms, and to exclude the new buildings; but there was a limit to which the Company were prepared to go. The Guardians also looked at electricity; but it was quickly dismissed on more than one occasion. Then they determined to seriously consider the application of the petrol air-gas system to the whole institution.

Installation Expenditure.

It was in October, 1912, that the Building Committee of the Guardians had before them various tenders for a petrol air-gas

installation for the whole of the old buildings; and the tender accepted was that of the same Company—Machine Gas Limited. The necessary new machines were to cost £364 4s.; the conversion of the existing machine so as to use "cheap" petrol of ·743 to ·760 sp. gr. was to entail an expenditure of £26 15s.; and the supervision of the pipe-work by the Engineer of the successful tendering Company was to be rewarded by the payment of £10. By the end of June, 1913, the new plant had been in use three months; and then in the minutes of the Committee presented to the Guardians, a detailed statement was published regarding the cost of the installation. This statement (which will be interesting) is as follows:

NEW PLANT—						
Two model "B" 300-light Cox's patent producer plants, fitted with continuous dual circuit petrol feed to evaporate petrol of ·745 to ·760 density	£245	14	0			
Shafting, &c, to connect to stationary petrol motors	9	18	6			
Two stationary internal combustion petrol motors of half-horse power each, fitted complete with circulating water-tanks and exhaust boxes	15	0	0			
333 Cox's burners (80 to 100 candle power), 3s. 6d. each	58	5	6			
140 Cox's burners (40-candle power), 3s. 6d. each	24	10	0			
Six gross of special "Helix" mantles at the *special* price of 36s. per gross	10	16	0			
				£364	4	0
Fee for supervision of pipe-work by Engineer of Machine Gas Limited				10	0	0
EXISTING MACHINES—						
Converting for use with ·745 to ·760 petrol, connecting-up to proposed countershaft, removing hot-air engine, refitting and fixing blower, supplying new petrol and surplus tanks, two petrol pumps and double reservoir, with various connections, &c.				26	15	0
PIPE-WORK AND DISTRIBUTING BOXES				42	16	2
Total cost of installation				£443	15	2

This total does not include the first machine purchased for the new buildings, the cost of the conversion of which is embraced in the tender. It should also be mentioned that the petrol motors were taken out during a test made during the quarter ending June, 1913 (to which reference is made hereafter), and were replaced by a small steam-engine.

ABSENT INFORMATION.

We do not know whether the whole of the 473 burners purchased were fixed, but 422 is the total number of burners and lamps mentioned as having been inspected by the Building Committee at the end of March, 1913. The figure, however, is interesting as being probably approximately correct; but it does not give any indication as to the amount of work the petrol air-gas plant is called upon to do. We have only information as to the nominal candle power placed upon the burners by the makers, and no particulars as to the actual measured illuminating power, or as to the hours of use. We believe, however, the light in the corridors, infirmary wards, and all night wards, is diminished as much as possible—at all events it appears to be so. It is a very singular thing that all through the *agenda* papers no results of photometric tests are given. We should like to see the results of a thorough photometrical survey made of the lights, and at intervals of time for comparison, as without data of this kind there are no means of judging the position as between coal gas and petrol gas in respect of illumination value for a given cost. It is all very well for a Committee to say that the buildings and yards were "well and sufficiently lighted," or, as they report in another paragraph, "the lighting and cooking by petrol gas throughout the institution is very satisfactory." This does not, coming from laymen, convey anything as to actual value. Then, again, cooking comes in to prevent any comparison being made which can be accepted as reliable; for one cannot tell whether the use of the petrol air-gas for cooking purposes was in any way on the same lines as with coal gas. About cooking this we do know, that the heating value of petrol air-gas is not that of coal gas. Even if there were no other charge than that for petrol in the production of air-gas, the price of the petrol would not have to be higher than 7¼d. per gallon to compete with coal gas of 600 B.Th.U. gross per cubic foot, at 2s. 6d. per 1000 cubic feet. We know, too, on very careful tests, that taking the *over-all costs* of petrol air-gas—that is to say, the total costs falling upon the consumer compared with the cost of coal gas delivered free of all charges other than that for the quantity of gas passed through the meter—especially at the price being paid to-day for petrol by the Romford Guardians, it is dearer than coal gas with equality of lighting and hours of use, quite apart from the worry of having to purchase and store petrol in quantities, the risk that there is in such storage, the labour that is incurred in the feeding, operation, cleaning, and watching of the plant, together with the additional work involved in its maintenance in working order.

UNCERTAIN PETROL PRICES.

The price of petrol is an important one. Petrol is never likely to be again at the old low prices of a few years ago. The Romford Guardians appear to have been encouraging the hope that it would be. In the minutes of the Building Committee of Oct. 8, 1912, it says that "a letter dated June 27 last from Machine Gas Limited, enclosing their specification and estimate was read, stating that the *estimated* cost of lighting [lighting only be it noted] for one year, using petrol of ·745 to ·760 density, at a contract price of 8½d. per gallon, free of duty, was £109 11s. 9d.; and cost of gas used for cooking approximately £11 1s.—total £120 12s. 9d." Why did Machine Gas Limited, in June, 1912, estimate on a contract price of 8½d. per gallon, seeing that petrol was, in the summer of 1912, selling at 1s. 6d. per gallon? We have not the information to say whether a quarterly test figure which we shall presently criticize, and which purports to show a remarkable saving over coal gas, is based on petrol at "a contract price of 8½d. per gallon," or on the figure which the Guardians are actually paying to-day, and which is not anything like 8½d. But whatever anticipations the Guardians may have entertained of continuing to get petrol at 8½d. per gallon, they have been ruthlessly destroyed by others than those who have petrol air-gas plants for sale; and there are not the faintest signs of petrol ever getting back to former prices. The claim of the plant adopted was that it would run with a "cheap" spirit, and money was spent on converting the first plant put down so that it might also be used with "cheap spirit." But notwithstanding this, we have in the Committee's minutes for July 13, 1913, a recommendation that, "in accordance with previous arrangements, the tender of the British Petroleum Company, Limited, to supply 'Crown Spirit' at 1s. 3d. per gallon, and 'Shell II' at 1s. 4d. per gallon, including Government duty, be accepted." In the minutes of the Committee dated Dec. 2, 1913, we find that the Clerk submitted tenders for the supply of petrol for gas making; and the tender accepted was that of the British Petroleum Company, Limited, at these prices: "Shell," 1s. 6d. per gallon; "Shell II," 1s. 4d., per gallon; and "Crown," 1s. 3d. per gallon. Is that "cheap" spirit? Anything but satisfactory to the Guardians must be this doubling of the cost of petrol since they first embarked upon the business without, as it seems to us, a thorough investigation of the actual illuminating value (photometrically assessed) that they were going to get for their money, using the "cheap" grade of petrol, without completely considering the over-all costs, and without taking into full account the hazard connected with a closely protected oil market.

UNRELIABLE DATA.

Now let us see (as near as the incomplete information in the minutes will allow us to do) how far other figures as to costs and saving effected are reliable. In October, 1912, the Committee reported that the average yearly cost of gas for the preceding four years was as follows:

Coal gas	£352	13	3½
Petrol gas	30	5	10½
	£382	19	1¾

The coal gas is here charged out at 3s. 3d. per 1000 cubic feet. The report mentions that the sum charged represents a consumption of about 2,170,000 cubic feet annually. We also remark in another report that the Romford Gas Company had offered to supply gas, if the whole of the buildings were coal-gas lighted, at 3s. per 1000 cubic feet. The 3s. on the above-named consumption would be equal to a saving of £27 2s. 6d.; and this subtracted from the £382 19s. 1d. would leave £355 16s. 7d. as the annual cost, on the methods and extent of use then in vogue. This was not all. As previously mentioned, a 10 per cent. discount was allowed, which reduced the price to 2s. 8½d. per 1000 cubic feet. We have also seen that the annual cost as estimated by Machine Gas Limited, was, with petrol at 8½d. per gallon, only £120 12s. 9d. Here we have a serious difference between this figure and the £355 16s. 7d., less the 10 per cent. on payment of the gas account. But the £120 12s. 9d. does not bear very close inspection, quite apart from the fact that we know that petrol air-gas cannot compete (to say nothing of attention and trouble) on the illuminating basis at current costs.

In the estimates in the minutes for Oct. 8, 1912, we see that to the £120 12s. 9d. is added for depreciation £60 per year, based on a seven-and-a-half years' purchase of the plant from Machine Gas Limited. This makes £180 12s. 9d. But the £60 depreciation is evidently only estimated on the £443 15s. 2d. constituting the total cost of the new installation as previously set out. It appears from our calculations that the Committee have taken no account whatever of the depreciation, on similar terms, of the first plant put down for the lighting of the new buildings, and for which they agreed to pay £96 10s. 6d. Here, again, there is no information available to see whether the sum covered the cost of the whole installation in the new buildings. Judging from the details already given, we should fancy that it did not. However, the depreciation on the plant we make out should increase annually the £60 by £12 17s. 4d., making £72 17s. 4d. This raises the previous estimate to £193 10s. 1d. Even now there does not appear to be anything allowed for repairs. A large plant of this kind cannot be installed and worked without necessitating repairs; and the depreciation does not cover this item. Then one cannot put down a large amount of plant such as this in any establishment without giving it general attendance during the hours of use, and without it involving some labour in cleaning, adjustment, and so forth during the hours that it is not in use. But we cannot trace any charge for attendance and labour. In

a workhouse perhaps there is so much spare labour that the Guardians do not place any value upon it. But if there is labour that can be used for managing and keeping in order such a plant as this, then the same labour could be employed on some other productive work, and a charge for it should accordingly be made against the plant. As a matter of fact, the supply of gas to the infirmary wards, &c., is continuous from sunset to sunrise; and this necessitates a boiler attendant throughout the night. Both petrol plants are run nightly until 8 p.m., when one plant is shut down, and the other run till morning. A night man is kept to watch the engine and the lights in the buildings; and if anything goes wrong, he has to call the engineer. In the test referred to in the succeeding paragraph this attention and boiler fuel (coal) appear to be valued at only £1 12s. 6d. for the three months! Engineers will not need any comment on that. If proper items were added for repairs and labour and the difference in the cost of petrol as between 8½d. and (say) 1s. 4d. per gallon, we should get to a financial complexion quite different from that presented by the minutes of the Building Committee.

A Quarter's Test.

It is only fair to say that we may soon be placed in possession of the costs of a twelve months' run of the plant. The twelve months expired at the end of March; but we are hoping that this criticism of the figures so far available will result in something more complete and reliable being forwarded to us, and something upon which we can compare and criticize the costs on the actual illuminating value basis, hours of use, extent of cooking, and so forth. However, during the quarter ending June 30, 1913, a test was made. In the minutes of the Committee for July 1, it is stated that the cost of lighting and cooking during the quarter was: Coal gas, £3 15s.; petrol gas, £23 19s.—total, £27 14s. A note to this states that £1 12s. 6d. has to be added for steam used by the new steam-engine during the period of the test that it was running in connection with the plant; and this made the total cost of lighting and cooking throughout the institution during the quarter £29 6s. 6d.—showing a saving on the gas bill for the June quarter of 1912 of £30 5s. 11d. That bill amounted to £59 12s. 5d.—viz., coal gas £51 16s. 10d., petrol gas £7 15s. 7d. We make out that the account shows a consumption of 319,000 cubic feet of coal gas, and that had this amount been charged out at the Gas Company's offer of 3s., the coal gas account would have been £3 19s. less, or £47 17s., less 10 per cent. There we have, in the first place, the so-called saving brought down to £26 6s. 1d. (and less including the discount). "So called" because we think that, as the facts are presented, it is anything but right to describe the £30 5s. 11d. as a "saving." We have already seen that depreciation on the Guardians' own figures should in connection with the old and the new plant be £72 17s. 4d. a year, or £18 4s. 4d. per quarter. Deducting, then, £18 4s. 4d. from the £26 6s. 1d., we have the "saving" brought down to £8 1s. 9d. If we only knew what would be the average charge for repairs during the life of the plant—the average of all the little incidental charges which accumulate about a plant of the kind—and the correct charge that should be made for attendance and labour (the demands made for labour and attention will increase with the ageing of the plant), this £8 1s. 9d. would be a vanished figure. We do not know whether the test quarter (which was a summer one, and therefore one of the lightest of the year) was run on the Machine Gas Company's "contract price of 8½d. per gallon" of petrol, or on the contract prices (of which we first find indications in the minutes for July 15, 1913), of 1s. 3d. and 1s. 4d. We have no information as to the quantity of illumination afforded at all seasons of the year, the hours of use, or anything else. It is all very vague. If the illumination was levelled-up and kept constant at the amount to be obtained from modern coal-gas burners, the "saving"—all expenses considered—would be a minus quantity. Unless further information (which we shall gladly welcome) puts a different complexion on the figures so far available, we do not think many other Boards of Guardians will be prepared to follow the example of the Romford Board—at all events, not until they have made a more exhaustive survey than the latter appear to have done of the whole position.

A Year's Costs.

Since the above article was written, a further equally vague report regarding costs on much the same lines as that for the first quarter has been issued for the year ending March last. How little reliance could be placed upon all previous estimates presented to the Guardians is shown by the expenditure now recorded—the figures have not worked out to anything like those predicted. The report states that the cost of lighting, &c., for the twelve months has been:

	£	s.	d.
Supply of petrol	275	10	5
Allowance for running steam-engine, 52 weeks at 2s. 6d. per week	6	10	0
Coal gas	3	10	0
	£285	10	5

The cost of lighting, &c., during the twelve months ending March 31, 1913, was:

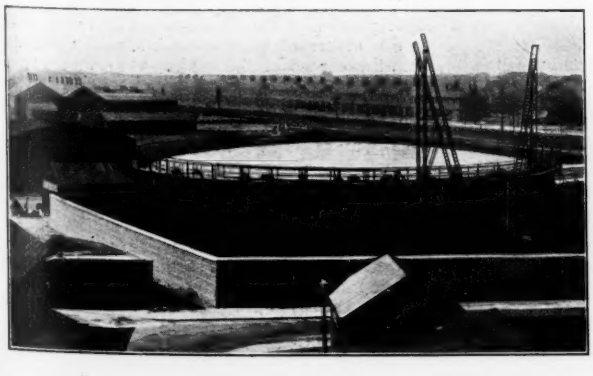
	£	s.	d.
Supply of petrol for air-gas	59	6	9
Coal gas	362	7	10
	£421	14	7

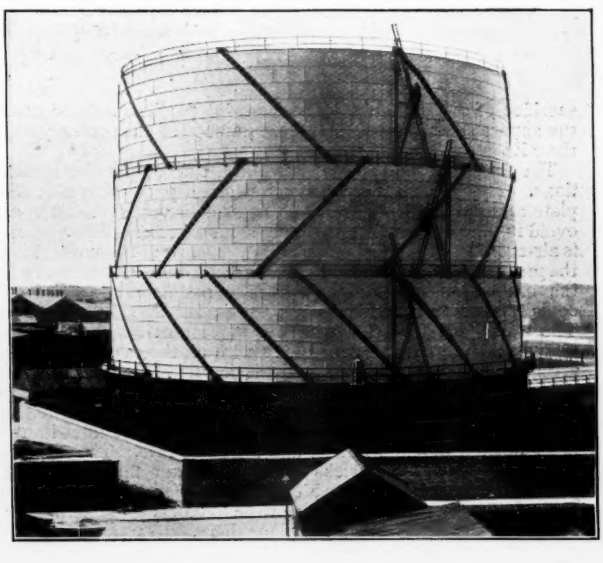
This, the report states, shows a "saving" of £136 4s. 2d., which is equal to 32 per cent. Why do the Guardians describe that as a "saving" when there is the depreciation to be allowed on the plant installed, which they calculate at £60, and which we reckon on their own figures should be £72 17s. 4d.? There is also, so far as we can see, nothing allowed for attendance and repairs, both of which points are criticized in the foregoing article. Then, too, we see that the cost of running the steam-engine during the hours of darkness is only charged at 2s. 6d. per week!

IMPROVED LADDER FOR SPIRAL-GUIDED HOLDERS.

We illustrate herewith an elevation of a three-lift spiral-guided gasholder recently erected by Messrs. Robert Dempster and Sons, Limited, of Elland, at the Fleetwood Gas-Works. One photograph shows the holder fully inflated; and the other, the three lifts down in the steel tank, which, it will be noticed, is strengthened by the adoption of vertical supports for the carriages, as recommended by the Local Government Board. Both photographs illustrate a ladder invented by Mr. J. W. Broadhead for use in connection with spiral-guided gasholders. The customary ladder gives very little toe-room between the side of the holder and the rung of the ladder, making it very arduous work to climb a spiral-guided holder of any height; and the difficulty is increased by the ladders being fixed vertically.

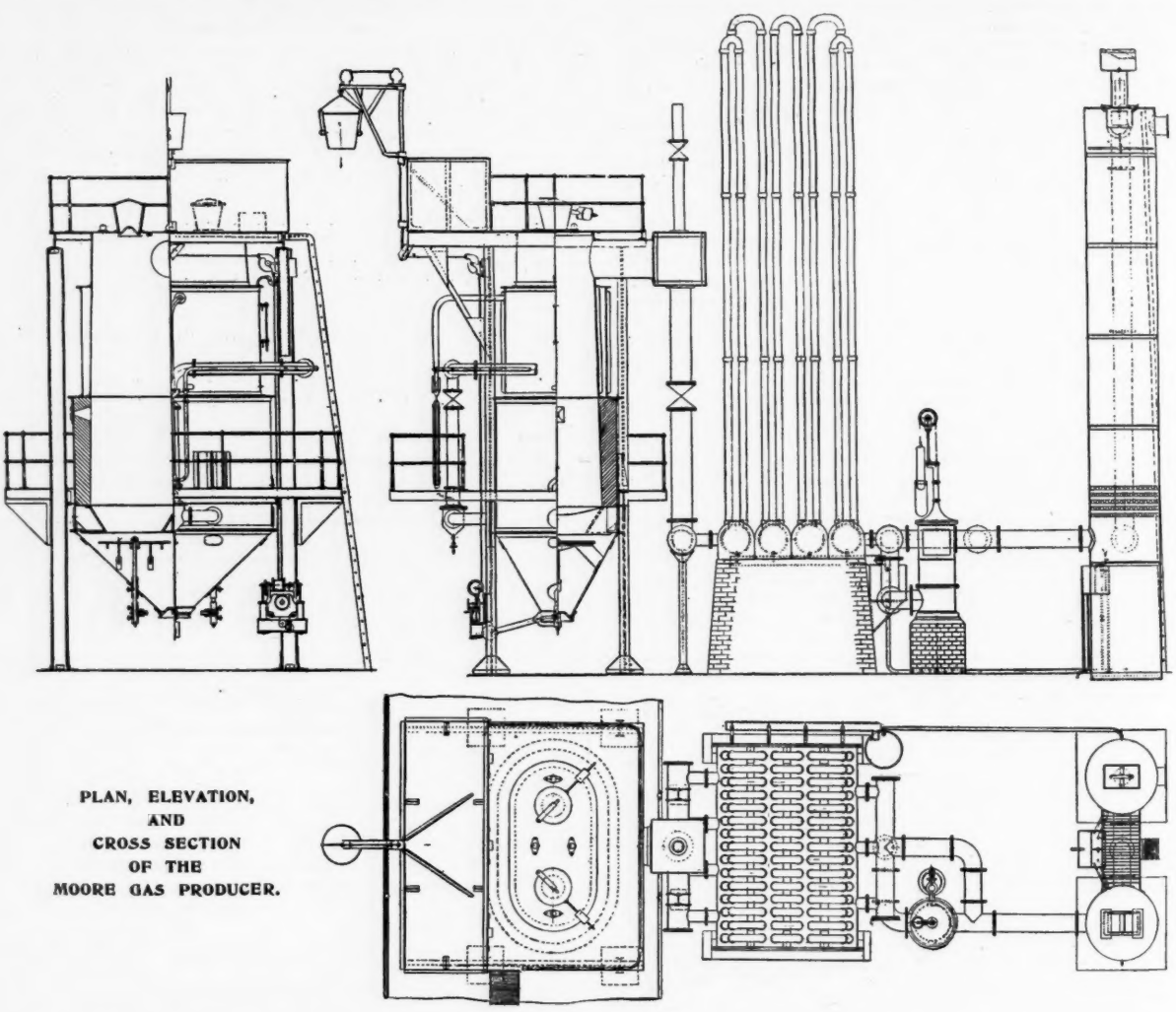
The invention consists, as will be seen, in placing the ladder for the inner lift on the dip of the second lift, that for the second lift on the dip of the third lift, and that for the third lift on the tank. The ladders are placed tangentially to the holder, are made of suitable slope, and are braced with a back-stay also attached to the same dip. These ladders, especially when the cups and dips are surrounded by a handrail, enable any carriage to be inspected by practically anybody about a gas-works at any time. They are as strong and firm as any ordinary ladder. It will be seen that when all three lifts are down the ladders are left standing beyond the top of the dips and of the tank; but this in no way detracts from the appearance of the holder and tank.





THE MOORE BYE-PRODUCT RECOVERY GAS-PRODUCER.

The most important factor in the economy of bye-product recovery producer practice in those types of plant which are best known at present is that of steam consumption, which amounts to about 1·5 lbs. per pound of coal gasified. This factor, taken in conjunction with the high initial cost of the plant, including the extra capital expenditure on steam-boilers, the low thermal efficiency of the plant, and the wetness of the gas, frequently acts as a deterrent to the installation of bye-product recovery gas-producers. The Moore producer is claimed to be an entirely new departure, and is designed with the object of gasifying the fuel under conditions which permit of the recovery of the tar and a large amount of the available nitrogen as ammonia without sacrificing the thermal efficiency of the plant or the quality of the gas. It cools the gases rapidly by means of a water-jacket, and is stated to permit of the use of a much smaller proportion of steam in the blast without any sacrifice of the ammonia. The following particulars in regard to the apparatus appeared in a recent number of our contemporary, the "Engineer."



PLAN, ELEVATION, AND CROSS SECTION OF THE MOORE GAS PRODUCER.

The design of the plant is shown in the accompanying illustrations. The producer shaft, which is made partly of $\frac{3}{8}$-inch steel plate and partly of brickwork, is conical in vertical section, and ovoid in plan. There are three distinct sections: The top section is air-cooled, about 3 feet deep, and extends from the underside of the producer top plate to the top of the water-jacket. In this section the gas outlet-pipe is arranged. The middle section is water-cooled, being surrounded by a water-jacket about 6 feet deep. The water-jacket outer casing is composed of $\frac{3}{8}$-inch mild steel plates, and the casing is furnished with all the necessary boiler-fittings. The pressure in the jacket is practically atmospheric, and therefore water can be fed into it by means of a Royles feed regulator; thus maintaining a constant level of water. The bottom section is composed of a mild steel casing, which contains the fire-brick portion of the producer and also the grate. The former is lined with special fire-bricks designed to suit the shape of the producer. In this section, which is about 4 feet deep, the highest temperatures in the producer are to be found, and the actual gasification of the coked fuel takes place there.

The grate is about 3 feet deep, and is composed of eight or more cast-iron sections in order to simplify manufacture. These sections are made so that a bridge is formed across the producer on the narrow axis, thus dividing the grate into two inverted cones. The grate as a whole is supported on cast-iron brackets and segment plates which are fixed to the shell of the bottom section. The plates also support the brickwork of the producer. The ash-hopper, which also has the shape of an inverted cone with flattened sides, is fixed to the angle or flange on the lower edge of the bottom section casing. This hopper is made of mild steel plates or cast iron, and is arranged with sides sloping at an angle sufficient to allow the ash to travel down easily. Poker-holes are formed in it; and these can be used, if necessary, to facilitate bringing down the ash. At the lower end of the hopper a shutter-valve is arranged for the withdrawal of the ash. In cases where one unit only is installed, a drum-cock valve is fitted in addition to the shutter-valve, to avoid any drop in pressure in the producer when the ash is being removed.

Supported on cast-iron brackets fitted to the side of the ash-hopper are two circular cast-iron ash-supporting tables, fixed on the same axis as the inverted cones forming the grate. These tables are arranged below the bottom of the grate, and are of such dimensions that they overlap the bottom circle of the grate cones by a larger amount than that necessary to accommodate the angle of repose of the ash. Two steel shafts, each carried in a bearing on the lower portion of the ash-hopper shell, and placed immediately below the centre of each ash-table, pass upwards and through a hole in the centre of the table. On each shaft is fixed a cast-steel arm, which rotates above and just clear of the table. At the lower end of each shaft a ratchet-wheel and pawl are fixed; thus allowing the shaft and arm to be rotated by hand or by mechanical means, and making it possible to bring down the ash from any particular portion of the producer as required.

The two inverted cones constituting the grate are perforated with vertical slots, which form admission ports for the blast to the fire. These slots are arranged round the outer circumference of the cones. The blast-box surrounding the grate is formed by the lower portion of the bottom shell, and provision is made for easy access to it for inspection at any time. The blast comes into this box by two inlet-pipes, each of which enters on the same centre line as the grate circles. The pipes are each provided with a screw-down valve close up to the producer shell, so that the

supply of air to either side of the blast-box can be regulated. Immediately below the grate, in the walls of the ash-hopper, poker-holes are provided to allow access to the ash on the tables, should it be necessary to remove pieces of clinker. To assure a constant and well-distributed feed of coal, the producer is provided with a fuel container, into which the fuel is charged through a hopper fitted with a gas-tight bell-valve and cover.

The cleaning and cooling plant is claimed to be simple and compact, and to require no skilled attention; and, as the recovery portion of the plant works automatically, labour charges are reduced to a minimum. The outlet and down-comer pipe from the producer is arranged with the smallest possible number of horizontal lengths, so that the dust will have the minimum amount of length on which to deposit; otherwise it slopes or drops vertically into the dust-lute. This is a mild-steel box provided with a water-seal through which the dust can be removed when required.

The inlet-pipe is on the side nearest the water-seal, and is connected to a cone-shaped pipe inside the box. This pipe is provided with slots so as to break up the volume of gas into a number of streams. A plate divides the box, and is provided with slots (similar to those in the cone) for further cleaning purposes. Provision is made for cleaning these slots through hand holes in the box. The exit-pipe from the dust-lute leads to an omnibus pipe, which distributes the gas to the atmospheric condensers or coolers. These are of the ordinary type, and consist of four batteries of 4-inch cast-iron pipes fitted into cast-iron chests. Between the second and third chests is placed a Pelouze and Audouin tar-extractor, the inlet of which is connected by a gas-collecting pipe to the second chest, while the exit is joined by a gas-distributing pipe to the third chest. The fourth chest from the producer is connected to a collecting-pipe which leads the gas into the main communicating with the ammonia scrubbers.

The scrubbers are made of $\frac{3}{8}$-inch and $\frac{1}{4}$-inch mild steel plate, and are 35 feet high; the diameter varying according to the size of the plant. They are filled with wooden grids to allow of a large scrubbing surface. The lower portion of each tower is usually arranged as a liquor-tank, from which the liquor is circulated by small centrifugal pumps. The first scrubber is provided with pipes at the top for distributing the liquor over the scrubbing surface; the second with two sets of distributing pipes—one at the top for distributing clean water, and the other half-way down for distributing weak liquor. By this means the gas is efficiently scrubbed free from ammonia before it leaves the plant. For small plants a tumbler, provided with a mechanical counter, is arranged on the top of the second tower, to allow the clean water added to be measured; and within certain limits the strength of the strong liquor leaving the first tower can be regulated. For larger plants a third tower so fitted is used. Between the first and second towers is an overflow and circulating box, which allows the weak liquor to pass from the second to the first tower, and the strong liquor to overflow from the first tower to a storage-tank. Tanks are provided for tar and ammoniacal liquor, and they can be placed under or above ground as required. The chests of the atmospheric condensers are connected by circulating pipes, which allow the tar and condensed steam containing ammonia to flow into the chest nearest to the producer. The auxiliary machinery required for the plant consists of an air blower and three belt-driven centrifugal pumps, which in small plants are worked from the blower engine.

The following particulars will give an indication of the working of the plant: The fuel is charged through the hopper into the container, from which it descends, and meeting the hot gases has its moisture driven off. In the water-jacketed zone the hot ascending gas and vapour are immediately cooled to a temperature below that at which ammonia is decomposed. The fuel is here also destructively distilled at a low temperature, so that tar and ammonia are formed, and the coke is rendered more porous and more suitable for gasification in the combustion zone. The resistance offered to the blast by the fuel in the producer is low. This, we understand, is partly accounted for by the easy slope of the producer itself, but is chiefly due to the simple design of the recovery plant. A very low pressure at the outlet from the producer is sufficient to force the gas through the rest of the plant, and incidentally this greatly reduces the loss of gas due to poking, &c.

The gas leaves the producer at a temperature of 180° to 230° C., and contains, it is stated, a relatively small amount of steam and dust. After the dust has been removed, the cooling of the gas is effected by passing it through the first series of atmospheric condensers, where it is cooled to a temperature suitable for extracting the tar. Thereafter the gas is passed into the second series of atmospheric coolers, where it is cooled to the outside temperature. The gas is then led into the scrubbing-towers, through which the weak and cooled liquor from the coolers and clean water circulate, and extract the ammonia, yielding liquor containing from 1 per cent. by weight of ammonia. This liquor is claimed as suitable for manufacturing ammoniacal liquor and ammonia salts.

The tar from the Pelouze and Audouin extractor runs into the second chest, and flowing, along with the water, to the first chest, where it meets the hot gas entering the condenser, is heated and freed from the finely divided water. The tar and virgin liquor flow from the first chest into a small tank, where they are separated by gravity. The tar flows into a storage well, and the liquor is run through a small heat-interchanger into the second tower, and used for scrubbing the gas. For the manufacture of sulphate of ammonia, the liquor is pumped through an ammonia still of any standard type; lime being added to liberate the ammonia present as fixed salts. The steam and gases are passed through a saturator, where the ammonia, coming in contact with sulphuric acid, forms sulphate of ammonia, which can be removed by an ejector as required. The foul gas and steam pass on, and are mixed with the producer blast. By this means the amount of steam required is reduced to the minimum, and the trouble of purifying the foul gas from the sulphate plant is eliminated.

The gas leaving the producer plant is claimed to be clean and practically free from suspended moisture, and to be eminently suitable for boiler firing and furnace work. Before being used in a gas-engine, it is desirable to further purify it by passing it through a sawdust scrubber. As to the dryness, tests taken gave the following average results:—

Atmospheric temperature (in shade)	68° Fahr.
Temperature of gas leaving plant	70° ,,
Suspended moisture per 1000 cubic feet of gas	910 grains
Equal to 10·2 per cent. on saturation vapour.	

The dry bottom grate is claimed to be a distinctive feature of the producer; and owing to the distribution of the blast the gasification of the coal is said to be perfect—the amount of carbon remaining in the ash not exceeding 1 per cent. of that calculated to be in the fuel. The steam required for the saturation of the blast does not exceed 1 lb. per pound of coal. Of this the water-jacket of the producer provides 50 per cent.; so that the requirements from outside sources do not exceed 0·5 lb.

The following figures, taken from the official trials of a plant recently installed, show the efficiency of the producer, and include the amount of coal used at the boiler for raising the extra steam required for the saturation of the blast:—

Steam used in blast per pound of coal gasified	0·8 lb.	..	1 lb.
	B.Th.U.		B.Th.U.
1 lb. of coal into producer.	11,145	..	11,122
Coal fired at boiler per pound of coal gasified	0·04 lb. = 446	..	0·07 lb. = 779
	11,591	..	11,901
Heating value of gas from 1 lb. of coal net	9,240·8	..	8,909
	Per Cent.		Per Cent.
Efficiency of plant	79·7		74·8

The net available heat of the gas is claimed to be 25 per cent. greater than that obtained from ordinary recovery plants; and the saving of steam, when gasifying one ton of coal per hour, is equal to 24 tons per day of 24 hours. The nitrogen recovered as ammonia when using 1 lb. of steam per pound of coal gasified is equal to that recovered in ordinary practice—viz., 80 to 90 lbs. of sulphate per ton of coal.

The following results of official tests allow a comparison of the effect of steam on the yield of sulphate of ammonia:

Coal—			
Wet coal gasified per hour	840 lbs.	..	840 lbs.
Approximate analyses—			
Moisture	8·05 p. ct.	..	8·06 p. ct.
Volatile matter	30·45 ,,	..	30·42 ,,
Fixed carbon	49·35 ,,	..	49·21 ,,
Ash	12·15 ,,	..	12·31 ,,
	100·00	..	100·00
Nitrogen	1·274	..	1·288
Blast—			
Pressure	8·75 W.G.	..	9·14 W.G.
Saturation temperature	73·6° C.	..	77·0° C.
Total steam used per pound of coal gasified	0·81 lb.	..	1·0 lb.
Steam raised in producer water jacket per pound of coal gasified	0·5 ,,	..	0·5 ,,
Air used per pound of coal in cubic feet at N.T.P.	28·8	..	28·3
Sulphate of ammonia—			
Yield per ton of coal gasified	67·3 lbs.	..	90·5 lbs.
Nitrogen recovered as ammonia	50·3 p. ct.	..	66·9 p. ct.
Gas—			
Yield per ton of coal gasified in cubic feet at N.T.P., B.Th.U. net	120,000	..	123,500
Heating value per cubic foot, B.Th.U. net	172·5	..	161·6
Analyses of gas as sampled—			
CO_2	8·2 p. ct.	..	11·6 p. ct.
CO	22·2 ,,	..	18·4 ,,
CH_4	2·8 ,,	..	2·2 ,,
H_2	23·2 ,,	..	26·0 ,,
N_2	41·8 ,,	..	40 0 ,,
Water vapour	1·8 ,,	..	1·8 ,,
	100·0	..	100 0

The tar produced contains 36 per cent. by weight of oils, and yields a pitch of good quality.

[The makers of the plant are the Dowson and Mason Gas Plant Company, Limited, of Glasgow and Manchester.]

We have received from the Secretary of the London Coke Committee (Mr. F. E. Rudge) two additional pamphlets they have just issued—one dealing with the use of gas coke for raising steam, the other with the grading and screening of coke fuel and its utilization for gas-producers. The wide application of gas coke as a fuel is shown by the list given by the Committee of the trades, &c., in which it is extensively employed.

TURF, SAWDUST, &c., FOR GAS MAKING.

The subject of the production of gas from other materials than coal has from time to time engaged the attention of investigators, whose efforts in the direction named have been duly recorded in the "JOURNAL." Among those who have lately devised plant for treating turf, wood, sawdust, and other solid combustibles, for making gas and recovering residual products, are MM. Galileo Guardabassi and Paul Goulliard, who have taken out a patent for France [No. 464,591] for a continuous recuperative furnace for the purpose. Its construction is shown in the accompanying diagrams, and its operation explained in the following particulars translated from the specification.

Figs. 1 and 2 are sectional elevations of the setting; figs. 3 and 4 are details of the retort itself. The open hatching represents ordinary masonry; the close hatching shows the portions of the retort which are protected by fire-clay.

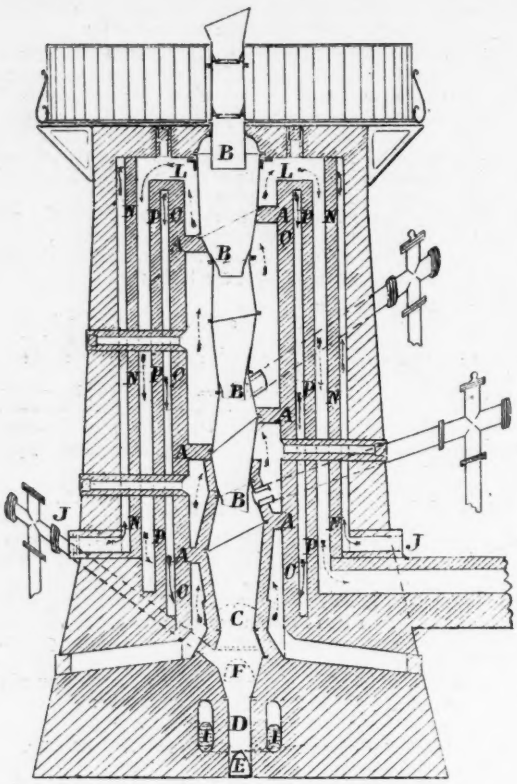


Fig. 1.

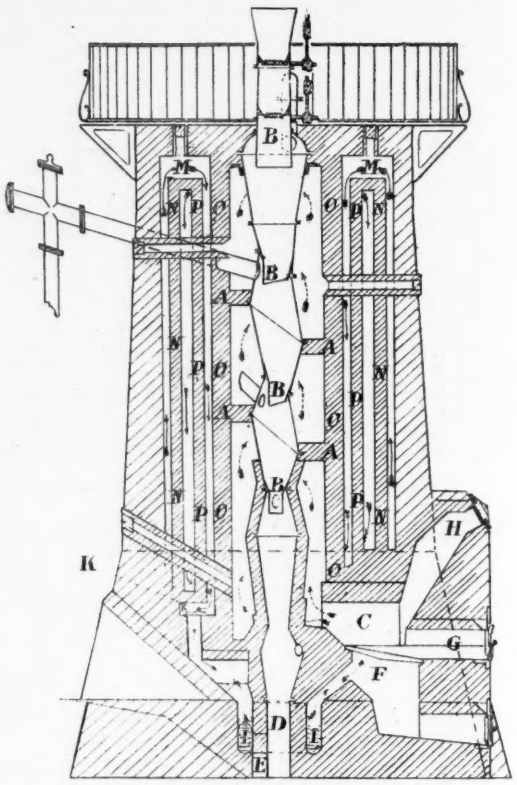


Fig. 2.

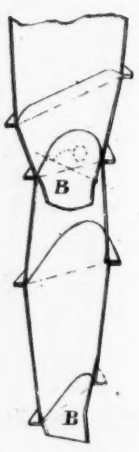


Fig. 3.

Fig. 4.

The retort is constructed of cast iron. It consists of a series of similar elements, each formed by two interchangeable truncated cones with inclined elliptical bases. The cones are adjusted upon their largest bases, as shown in dotted lines at the bottom of fig. 4, so as to form one element; and the elements are assembled on the small bases, shown in dotted lines just above the pipes to the right of that figure. The upper part of each element has an orifice provided with flanges, upon which is fitted a pipe A (fig. 4), at a angle of about 15°, through which the gases produced by the decomposition of the materials under treatment escape. Each of these pipes is connected directly with a condenser specially adapted for the recovery of the bye-products. The lower part of each element is furnished with a prolongation B, which descends into the orifice of the element below. This prolongation regulates continuity and uniformity in the descent of the material, protects the orifice against obstruction, and forms with the walls of the upper part of the succeeding element a space where the gas can accumulate before passing off through the pipe A.

The retort is worked as follows: The material leaving the chargers shown at the top of figs. 1 and 2, drops into the higher portion of the first element, where it begins to dry and decrease in volume. It then passes into the second element, where desiccation is completed and distillation begins. Thence the material, under the pressure of the charges, goes successively into the other elements. During this downward movement, which takes place through elements in which the heat increases in proportion to their nearness to the furnace C, the volatile constituents of the material are liberated in the state of gas, and pass off to the respective condensers through the outlet-pipes shown. Carbonization is completed in the last element, and the resulting coke descends into a cylinder D, in which there is a water arrangement for quenching it. The coke is withdrawn at E.

The retort is heated by the furnace, which consists of an ordinary grate F (the bars of which are fixed at an angle of about 10° towards the front of the setting), an ash-box, a clinkering chamber G, and a fuel chamber H, kept constantly full, and fitted with a hermetically closing door. The inclination of the sides of this chamber allows the fuel to slide easily on to the grate, and collect there in a uniform heap. To start the furnace, the chamber G is opened and a fire kindled on the grate. Then the door of the furnace is closed, and a current of air, arriving through the passages I, assists combustion. As soon as this is sufficiently intense, the current of air is cut off, and the furnace draught causes a fresh intake through the opening of the dampers J, in communication with the passage K.

The combustion gases are, by means of baffles, led away in a spiral direction, as shown by the broken arrows, until they reach the top of the retort, where they enter the flues L, which terminate in a chamber connected with the chimney. In their upward and downward travel they heat the walls of the retort. The cold air, brought in by the dampers J, in rising towards the channels M (fig. 2), becomes heated by contact with the wall N; and it descends into the last chamber formed by the walls O P, in contact with which it becomes superheated, and reaches the passage K, whence it communicates, by the channel I, with the furnace. In this channel the water is at its normal level, and occupies the whole of the lower part. It is in constant contact with the hot coke, owing to the repeated drawing of this product through E; and this creates a certain amount of steam. The superheated air coming from K, in passing through the channel I, increases the vapour, and entrains it under the grate.

The annual meeting of the Association of Consulting Engineers will be held at Caxton Hall, Westminster, on Monday next.

INDICATORS: THEIR USE IN ANALYTICAL WORK.

By M. Langslow.

Accuracy in volumetric analysis depends upon three factors—first, manipulation; secondly, the standard solutions; and in the third place, a suitable indicator. It therefore behoves all works chemists to pay particular attention to this matter when making any tests or analyses. The writer has, in his experience, come across many faulty results which have been obtained because of the misapplication of an indicator. It is especially advisable to make quite certain that a correct choice has been made when working along new lines.

Now, broadly speaking, a chemical indicator may be described as a substance which will give a definite colour change in a mixture of solutions when either of the solutions is present in greater proportion than is required to bring about a known equilibrium. As an instance, let us take the case of ammonia estimations in gas. A known amount of gas bubbles through a measured volume of acid, whereupon a proportion combines with the ammonia it absorbs. In the act of titration with soda, we estimate the amount of free acid (calculating the quantity of ammonia by difference). In this titration, then, sufficient soda is added to produce the state $H_2SO_4 + 2NaOH = Na_2SO_4 + 2H_2O$. Without the addition of a foreign substance, one could not recognize exactly when sufficient soda had been used. Hence, to demonstrate this precise point ocularly is the particular object of the indicator.

The table given below describes a series of these bodies, and enumerates their properties and uses.

As will be seen, there is no lack of variety in the classes of compounds used for this purpose; and it is therefore advisable to consider the several important points bearing on the choice of suitable substances for special tests. The old practice of using any indicator—usually the nearest at hand—for a valuation is no longer permissible. There is only one indicator to use, and that is the correct one.

We are influenced in our choice by considerations which I bring under four general headings.

I.—Colour of Solutions—Before and After Titration.

(*a*) In the valuation of iron salts (as used for cyanogen purification), the reduced solution may be titrated with potassium permanganate ($KMnO_4$). This compound is decolorized as long as any ferrous salt remains in solution; but immediately all has been oxidized to the ferric state, the unchanged permanganate imparts its deep rose tint to the solutions. In this case, it is evident that no additional indicator is required.

(*b*) In treating picric acid solutions (from naphthalene tests) it is obvious that such a body as methyl orange is of no use, for the colour change is masked by the yellow of the picric. Litmus or lacmoid gives distinct changes in colour; and as the latter is more sensitive to alkalies, it is generally used for the work.

II.—Action of Solutions (Separate and Mixed) upon the Indicator.

It is found in many cases that solutions will decompose the indicator; and hence alterations become necessary. Nitrous acid instantly prohibits the use of methyl orange; litmus is unreliable with carbonic acid or sulphuretted hydrogen in the cold; ammonia interferes with the delicacy of phenol phthalein; hydrochloric acid affects permanganate; and so on. Reference to the table below will show fairly well the suitability of the various materials for specific purposes.

III.—Chemical and Physical Nature of the Solutions.

(*a*) Great care must be taken in titrating acid solutions, metallic salts, &c. In numerous cases one indicator will show apparent acidity, while another shows alkalinity. Sulphate of zinc and sulphates and chlorides of iron and copper are acid to litmus, but neutral to methyl orange—proving the superiority of the latter as a means of estimating the free acid in the above-named and similar compounds. Similarly, sodium bicarbonate ($NaHCO_3$) and sodium hydro-sulphide (NaHS) react neutral to phenol phthalein, but alkaline to litmus and methyl orange. The effect of sulphuretted hydrogen is a good example of what is meant. With methyl orange an accurate result is obtained at ordinary temperatures; with litmus a result can only be obtained after boiling; whereas phenol phthalein is of no use whatever.

(*b*) The presence of any large quantity of organic compound—such as alcohol or acetone—very often limits the degree of accuracy of certain of the indicators. The former, for instance, has a marked disturbing tendency on phenol phthalein. In all such instances it is well to conduct simultaneous blank experiments as a check upon the test.

IV.—Sensitiveness of Indicator.

In regard to this point, it may be taken that methyl orange, congo red, cochineal, and lacmoid are most sensitive to alkalies; phenol phthalein and turmeric, to acids; while litmus and rosolic acid are of comparatively medium sensitiveness. The choice depends very much upon the degree of accuracy required for the work. A good example of this is shown in Long's method

Name.	Properties.	Strength.	Applications.	Unsuitable For
Cochineal	Purple powder Acid, reddish yellow Alkali, violet	Digest with 10 parts of 1-2 alcohol water	Ammonia, alkaline earths, carbonates (Sulphides—hot)	Weak organic acids, iron and aluminium compounds
Congo Red	Red powder Acid, blue Alkali, red	0·5 gramme in 100 c.c. water	Ammonia (Sulphides—boiling)	Organic acids Chlorides, sulphates, and nitrates of alkali metals prejudicial
Iron Alum	Crystals	2 per cent. aqueous solution	Estimation of cyanides	
Lacmoid	Dark powder Acid, red Alkali, blue	0·5 per cent. solution, in 1-2 alcohol water	Mineral acids, alkali earths, and oxides Salts as copper sulphate, ferric chloride, &c.	Carbonates, sulphides, sulphites, and phosphates interfere
Litmus . . . . . (Azolitmin)	Blue powder Acid, red Alkali, blue	Extract with hot water filter, adjust tint with few drops of dilute hydrochloric acid	Hydrates and oxides of sodium, potassium, ammonium, calcium, barium, &c. Oxalic and mineral acids (Carbonates and sulphides—boiling)	No use for carbonates, sulphides in cold Weak organic acids
Methyl Orange . . .	Bright orange-red powder Acid, pink Alkali, yellow	0·1 per cent. aqueous solution	Hydrates, carbonates, sulphides, of sodium, potas ium, &c. Mineral acids, hydrocyanic acid. Phenol.	Not for organic acids or nitrous acid
Phenol Phthalein. . .	White powder Acid, colorless Alkali, red	1 per cent. solution in 1-1 alcohol water	Hydrates of alkali metals, mineral and organic acids	Ammonia and its salts interfere. No use for weak bases or for carbonic acid in cold
Potassium Chromate .	Yellow crystals	2 per cent. aqueous	Halogen acids	
Potassium Ferricyanide	Dark red crystals	2 per cent. aqueous Used externally	Ferrous salts in presence of hydrochloric acid	
Potassium Permanganate	Dark purple crystals	Standard solutions	Ferrous salts, ferrocyanides	Hydrochloric acid interferes
Potassium Thiocyanate.	White crystals	2 per cent. solution	With silver salts	
Rosolic Acid	Dark brown lustrous solid	½ per cent. solution in 2-1 alcohol water	Hydrates of alkali metals, mineral acids, sulphites. (Carbonates and sulphides—boiling)	Ammonium salts, organic acids, carbonates in cold
Starch	White powder Blue with Iodine	½ gramme in little water poured into 100 c.c. of boiling water	Ammonia liquors, phenols, ferro- and ferricyanides, &c.	
Turmeric Paper . . .	Yellow Acid, yellow Alkali, brown		Carbon dioxide in air and coal gas by Pettenkofer's method	Ammonia and alkali carbonates, sulphurous acid, and sulphuretted hydrogen

for the approximate determination of pyridine in the presence of ammonia. The mixture, which must not contain any fixed alkali, is titrated with standard acid, using phenol phthalein. A fair amount of the indicator should be employed, and titration performed at a low temperature. The pink colour disappears when the ammonia has all (or thereabouts) been neutralized. Subsequent titration with acid, using methyl orange, gives the pyridine content. Though, as has already been mentioned, this particular indicator is unreliable with ammonia, very concordant results are obtained and an enormous saving in time is effected.

The characteristic differences referred to in Clause III. (*a*) are made use of in "double titrations." Suppose a liquid is to be tested quantitatively for sodium hydrate, carbonate, sulphite, thiosulphate, and sulphide. Five titrations will serve to yield all the data required—

(*a*) Titrate with acid, using methyl orange → NaOH, Na_2CO_3, Na_2S, and half $Na_2SO_3 + Na_2S$.
(*b*) Acidify with acetic, and titrate with iodine (starch) → Na_2SO_3, $Na_2S_2O_3$, Na_2S.
(*c*) Treat with cadmium carbonate, and titrate with iodine → Na_2SO_3, $Na_2S_2O_3$.
(*d*) Treat with barium chloride, and titrate with acid (methyl orange) → NaOH, Na_2S.
(*e*) Treat with barium chloride, acidify with acetic, and titrate with iodine → $Na_2S_2O_3$, Na_2S.

Thus—

$$Na_2S = b - c.$$
$$Na_2SO_3 = b - e.$$
$$NaOH = d - Na_2S.$$
$$Na_2S_2O_3 = e - Na_2S.$$
$$Na_2CO_3 = a - d - \tfrac{1}{2}Na_2SO_3.$$

In this way, work that would otherwise take a very long time is performed in a quarter-of-an-hour. There is quite a big scope for work along these lines, and it will very readily be seen what advantages are offered, considered from the time point of view. Where rapid routine work is encountered, this becomes of especial importance. There is, indeed, need for greater attention to this more or less specialized (and certainly much neglected) aspect of chemical practice. Many a time it happens that young chemists are confused by "impossible" results when working with a new reagent, just for want of a few minutes' consideration.

In performing volumetric tests, it is well to keep the conditions as uniform as possible. Have a white surface beneath the containing vessel. Never use too much indicator, or the end-point is not sharp. If possible, avoid titration of hot liquors, as all indicators are less sensitive when hot. A "neutral" mixture of sulphuric acid and caustic soda, using methyl orange, becomes distinctly yellow on warming, regaining the original tint when cool.

When checking standard solutions, it is advantageous to use the same indicator as will be employed in the subsequent analytical work—in fact, it is essential, because the end-points are not quite the same.

DETERMINATION OF AMMONIA IN ILLUMINATING GAS.

Investigation by the United States Bureau of Standards.

THE United States Bureau of Standards have issued a Technologic Paper (No. 34) containing the results of a brief investigation of the apparatus and methods employed for the commercial determination of ammonia in illuminating gas. An abstract of the paper appears in the "Journal of the Franklin Institute."

The method generally used for the determination of ammonia in purified illuminating gas depends upon the absorption of the ammonia in a standard acid solution; the amount of ammonia absorbed from a measured volume of gas being determined either by titration of the acid remaining unneutralized, or less frequently by allowing the gas to pass until a change is shown by the indicator used. The choice of the proper indicator to use for this determination is of greater importance than the choice of apparatus. The indicators found to be most suitable were sodium alizarinsulphonate, cochineal, and paranitrophenol. The presence of glass beads, which are used in some of the absorption apparatus, may lead to erroneous results, for two reasons—first, the beads may yield alkali on contact with the absorbing liquid; secondly, the washing of the beads may be incomplete. It is recommended that the operator should test the solubility of any beads he may have to use, and also the method of washing-out the apparatus.

Five different forms of apparatus were tested: The Referees' apparatus, the Emmerling tower, the Lacy apparatus, the common form of gas wash-bottle, and a modified form of the Cumming gas-bottle. The relative efficiency, and from this the probable accuracy, of the different forms of apparatus were determined by running them in parallel, using gas from a common supply. As a result of this comparison, it was found that the Emmerling tower gave results which were somewhat higher than those obtained with the other forms, and the wash-bottle others which were consistently lower. The conclusion come to is that, with careful operation, any one of the five forms of apparatus tested would ordinarily give results that are well within the limits of accuracy required for this determination, either for commercial control work or for the purpose of gas inspection.

GASHOLDER CUPS UNSEALED BY WIND.

THE "Question Box" of the "American Gas Institute News" a short time ago contained an inquiry for an authenticated case of the wind blowing the water out of the cup of a telescopic gasholder to the extent of unsealing. Mr. R. E. Wyant, of New Haven (Conn.) cited one, and his answer is given in the number of the "News" for the present month, as follows:

In January, 1913, the second cup from the top of a five-lift 3 million cubic feet holder in New Haven unsealed during a storm, when the wind maintained a velocity of 40 miles an hour for eight hours previous to unsealing. The wind blew from an unusual direction, where the surrounding structures produced abnormal suction on the cups. The holder cups are 18 inches deep, and the grip sheet extends 18 inches above the grip channel. The grip and cup channels are each 10 inches wide—thus making an annular space 5 inches wide between the grip sheets and sides of the sections.

Three-and-a-half sections of the holder were elevated, giving a holder pressure of 13½ inches; and the holder had been completely shut off for several hours previous to the unsealing. At 6 p.m. the cups were examined, and the water was found to be from 5 to 7 inches below the top of the grip sheet in the three cups in action. Spray was blowing from the seals; but the level above indicated would correspond to from 17 to 15 inches effective seal. The measurements of water levels were, however, taken from the holder stairway, which, with reference to the direction of the wind, was on the lee side of the holder, where the level would be raised by the wind pressure. These measurements were therefore probably misleading, and did not indicate the effective seal.

A recording pressure-gauge showed that the holder began to blow at 8.50 p.m., and continued to blow until the second cup from the top reached the water in the tank at 9.30 p.m. This record also shows that only the second cup unsealed. There was no freezing weather for ten days previous to the occurrence, so that the question of possible injury to the cups from freezing is eliminated, and the possibility of syphoning through the steam-heating hose is equally well disproved.

The following day the holder was raised, and all the cups were examined, and found in perfect condition. By this process of elimination, the only cause remaining is that the cup was unsealed by the wind.

INSTITUTION OF WATER ENGINEERS.

Programme of the Summer Meeting.

THE Nineteeth Summer General Meeting of the Institution of Water Engineers will be held at Stockport from the 11th to the 13th prox., under the presidency of Mr. Thomas Molyneux, Assoc.M.Inst.C.E., the Corporation Water-Works Engineer. We learn from the circular issued by the Secretary (Mr. Percy Griffith, M.Inst.C.E.) that, by permission of the Mayor and Corporation, the meetings will be held in the Town Hall; and at the opening of the proceedings the members will be welcomed by the Mayor (Councillor Thomas Worthington Potts, J.P.). The President will deliver his Inaugural Address; and the following papers have been promised for reading and discussion at the meeting:

"The Character of Mechanically Filtered Water," by Professor Sheridan Delépine, of the University of Manchester.

"The Aëration and Filtration of Water for Swimming Baths," by Mr. L. Holme Lewis, M.I.Mech.E.

"Notes on Scraping a Fifteenth-Inch Water-Main," by Mr. J. S. Barrowclough.

The President will furnish a description of the Stockport Water-Works, with a map of the district of supply; and a lecture will be delivered by Professor George Hickling, D.Sc., of the University of Manchester, on "The Geological Structure of the Stockport District."

The members will be entertained at luncheon by the Corporation in the Town Hall on the opening day; and in the afternoon they will visit the Wilmslow pumping-station and softening works, and also the Alderley balancing reservoir (in course of construction in reinforced concrete), where tea will be provided by the President and Mrs. Molyneux. In the evening the annual dinner will be held in the Midland Hotel, Manchester, when the Lord Mayor and other distinguished guests will be entertained by the Institution.

On Friday, the 12th prox., visits will be made to the recently completed Kinder reservoir and filtration plant, where luncheon will be provided by the Corporation of Stockport, and to the Lyme Park reservoirs; also to the works of Messrs. Mirrlees, Bickerton, and Day, Limited, where the members will see Diesel oil-engines under construction, and where tea will be provided. The next afternoon the members will be free to visit the Colliery Exhibition at the Victoria Public Baths. At the latter they will see an installation of plant for filtering the water used in the swimming baths.

CHEMISTRY OF COAL CARBONIZATION.

In the "JOURNAL" for the 10th of February (p. 351), a brief notice appeared of a lecture delivered by Dr. JOHN HARGER, M.Sc., before the Liverpool Section of the Society of Chemical Industry, on the subject of "Coal and the Chemistry of its Carbonization." The lecture was published in the number of the Society's "Journal" for the 30th ult., and we to-day reproduce it practically in full.

INTRODUCTION.

Very little is known of the chemical composition of the various constituents of coals, though some progress has been made by several workers in separating them by the solvent action of pyridine, as discovered by Professor P. Bedson. Some coals—such as anthracite, semi-anthracite, and steam coals—yield very little pyridine soluble matter; neither do brown coals nor cannels yield very much. But some bituminous coals give as much as 40 per cent. extract. The utility of the pyridine extraction method is, however, impaired by the facts that the ultimate chemical analyses of the soluble and insoluble portions from the same bituminous coal differ very little, and that up to now all the fractions contain more nitrogen than the original coal; indicating that some pyridine, in spite of all the precautions employed to remove it, has been retained by the coal substances. By the usual soxhlet method, the quantity slowly dissolved by pyridine is large at first, then more is dissolved very slowly indeed. An extraction usually extends over two weeks at least. The author has lately found that a better method is to take a small quantity of the finely powdered coal (passing through 120 mesh sieve)—say, about one gramme—add 150 grammes of pyridine, seal in a strong glass tube, and heat to about 160° to 180° C. for 24 hours. By this method more extract is obtained in that time than by the usual method in months.

RESULTS OF EXPERIMENTS.

The chemists at the Government Experimental Station at Eskmeals have found that the inflammability of coal dust is in proportion to the quantity soluble in pyridine. The French Government chemists, however, have found that, for French coals at least, this relation does not apply. The author has found that cannel coal contains very much less soluble in pyridine than ordinary bituminous coals—*e.g.*, by the soxhlet method. Old Roundwood cannel yields 15½ per cent., and Lancashire Arley coal 22½ per cent. Yet there is no doubt whatever that the cannel dust is far more inflammable than the dust of the Arley coal, each of the same degree of fineness. It was found, however, that Arley coal dust, which gave only 22½ per cent. soluble in pyridine by two weeks' extraction in the soxhlet, gave 40½ per cent. soluble in pyridine by the sealed-tube method. A portion (150 grammes) of a different sample of Arley coal, but taken from the same mine, was extracted first by chloroform and then by several portions of pyridine, boiling up in each case for a long time, till only a trace of soluble matter was obtained. Some of the residue was then taken and heated in a sealed tube for 34 hours at 160° to 180° C., and the residue from this heated with a fresh portion of pyridine for 24 hours at 160° to 180° C., with the following results, stated on the dry and ash-free substance: 3·9 parts soluble in chloroform (A), 18·1 parts soluble in pyridine (B), and 78 parts insoluble in pyridine by the soxhlet method (E). Of the 18·1 parts (A), 6·7 were soluble (C) and 11·4 insoluble (D) in chloroform; and of the 78 parts (E), 9·2 were soluble in pyridine in a sealed tube in 34 hours (F), 1·3 parts in 24 hours (G), and 67·5 parts were residue (H). Some of the fractions were saturated with chlorine, after removal of pyridine, &c., in a current of inert gas at 150° C., and the increase in weight is stated below. Chlorine and hydrochloric acid were removed *in vacuo* over sodium hydroxide. Increase in weight, per cent.: Fraction B, 74·4; C, 64·4; E, 55·7; F, 31; H, 64·2.

A considerable number of experiments have been made on the action of chlorine at high temperatures. CH_3Cl, CH_2Cl_2, $CHCl_3$, CCl_4 and C_2Cl_6 in large quantities were obtained, but further experiments are being made which will be reported later.

The fact that pyridine dissolves the so-called resin bodies so very slowly, and dissolves much more with the slight increase in temperature by the sealed-tube method, shows that this is not a case of ordinary solution. The extract once obtained is quite readily soluble in pyridine, and gives a thick, viscid, tar-like mass; and that it is not "absorbed" by the insoluble portion of coal is proved by examination of thin sections, which show the resinous bands and nodules to be separate from the general matrix.

There appears to be some kind of simplification in the constitution of the constituents which yield the pyridine soluble matter—a process similar to depolymerization, and due to the action of pyridine and heat. This is similar to the behaviour of many ordinary resins, which are only soluble in certain solvents after they have been heated at moderately high temperatures for some time. Clark and Wheeler have shown that the pyridine extract from Silkstone coal can be separated into two fractions by the solvent action of chloroform; and the author has found that this is the case with the pyridine extract from Arley coal also. The solution by chloroform is an extremely slow process, and requires about two weeks to make the extraction complete. This points to either absorption or depolymerization.

An interesting point is that this chloroform soluble portion does not appear to be in the original coal as such. There is some portion of Arley coal soluble in chloroform, and the quantity seems to vary very much with coal even from the same seam. In one experiment it was as much as 3·9 per cent.; but generally it did not exceed 1½ per cent. This substance contained no sulphur and no nitrogen, and gave, on analysis, hydrogen 8·81 per cent., carbon 83·92 per cent., and oxygen 7·27 per cent. The portion dissolved out of the pyridine extract by chloroform was rather more than one-third of the total pyridine extract, and this material contained nitrogen and sulphur as well as carbon, hydrogen, and oxygen.

In the paper by Messrs. Clark and Wheeler, results of extraction of Silkstone coal (Altoft's Colliery) by pyridine, and the subsequent action of chloroform on the extract obtained, are given, with analyses of the various fractions. From their figures it is evident that all fractions contain more nitrogen than the original coal; and it appears on calculation that pyridine amounting to 4 per cent. on the coal taken has been retained by the fractions. Examination of their figures also shows (assuming the analyses to be correct) that in the extraction by pyridine, and subsequently by chloroform, a considerable quantity of oxygen has been absorbed and some sulphur lost. These figures show that (1) 100 parts of coal have retained slightly more than 4 per cent. of pyridine; (2) oxidation has occurred in both extractions, but especially with chloroform, where the oxygen has increased by nearly 60 per cent.; (3) there is loss of sulphur in both extractions. It might be gathered from the figures that the absorption of oxygen is an essential feature in the solution of these constituents by pyridine and chloroform; but the fact that more is dissolved by treatment in a sealed tube in the absence of air proves that this is not so.

The fact that pyridine is retained by the fractions even after heating *in vacuo* at 100° C. for several days has been proved by heating a portion of pyridine extract in a current of nitrogen at 150° C. The gas which came off contained pyridine, and was passed through sulphuric acid, which was distilled later with potash and the distillate titrated. This experiment revealed the presence of 3·7 per cent. of pyridine in the material. Later experiments have shown that the insoluble portion contained pyridine after heating *in vacuo* for several days at 100° C., and it has been found much more difficult to remove all the pyridine from the insoluble than from the soluble fractions.

THE COKING PROPERTY.

Not every coal gives a satisfactory coke on carbonization. A coal which will coke must contain a certain minimum quantity of bituminous matter. Coals like anthracite and semi-anthracite do not coke, nor do the tertiary coals, lignites, and brown coals. The coals selected for making metallurgical coke contain sufficient bituminous matter to fuse on heating to a few degrees above 310° C. The mass of washed coal is converted on heating to a pasty mass, from which, on further heating, the volatile matters distil, leaving a fixed carbonaceous residue which becomes harder and stronger the higher the temperature employed, because volatile hydrocarbons are decomposed, with deposition of carbon, in proportion to the temperature of the solid material through which these volatile hydrocarbons have to pass. With very high temperatures, the product is hard, and will withstand considerable pressure.

It appears that the coking properties of coals must be due to some compounds of C, H, O, N, and S, about which little further is known than that they melt at about 320° C. Anderson and Roberts showed that coals of the Clyde Basin began to soften at 310° C., and melted fairly completely at 320° C. The best coking coals melted at 317° C. The older coals coked, the newer ones did not.

Kind of Coal.	Carbon.	Hydrogen.	Oxygen, &c.	Coking Power.
Non coking .	82·65	5·55	10 10	3·9
Semi-coking .	83·16	5·48	8 98	4·4
Coking . . .	85·41	5·36	7·22	13·5

It is not possible to tell, from the ultimate analysis of a coal whether it will coke; but it is often found possible to say that it will not coke. Cases are known of coals of exactly the same ultimate chemical composition, some of which coked quite well and the others not at all. An essential part of this process of coking takes place between 250° C. and 400° C. If coking coal is carbonized below 400° C., then powdered and heated to very high temperatures such as are employed in metallurgical coke-ovens, there is no sign of sticking together of the particles. It is generally believed that it is the quantity of the so-called resinous constituents in coal which determines its coking or non-coking property. According to Anderson, this has been proved to be wrong, but on what evidence is not clear. A study of his papers reveals no facts supporting this conclusion.

Some of the fundamental facts about the coking property are: (1) The coking property in some coals is destroyed by exposure to air, and even in more strongly coking coals it is sensibly diminished. (2) The coking property in some coals is destroyed, in others weakened, and in some not affected by boiling with dilute caustic potash. (3) Heating in a current of inert gas at 300° C. for several hours destroys the coking power of some coals and weakens it in all coking coals. The strongly coking coals, however, retain sufficient to coke when strongly heated.

Anderson and Roberts conclude, and Professor Vivian B. Lewes agrees, that on these facts strongly coking coals, in addition to the so-called resin bodies, contain a class of substances which are

not soluble in alkali, do not oxidize in warm air, and do not decompose or volatilize at 300° C., and that substances of this class melt on strongly heating, and yield enough luting material to form coke. They call the substances of this class the "hydrocarbon bodies." The assumption or deduction of the existence of a class of compounds in coal called hydrocarbons, on such evidence, is not, in the author's view, justifiable; and they must be omitted from the constituents of coals. [Hydrocarbons have been found only in mere traces in coals.]

The phenomena previously described would be observed if the so-called resin and other bodies on slow heating, &c., decomposed, and yielded, among other products, a smaller quantity of a substance which was fusible at higher temperature. This is what the author has found does actually take place. The true coking coals contain sufficient resin-like bodies to yield, after heating at about 300° C., sufficient fusible material to form coke when heated to 320° C. or above. While the feebly coking coals on heating, &c., gave the same kind and proportion of fusible bodies, the quantity was not sufficient to melt or render liquid the whole of the material, and so coke could not be formed.

A sample of Arley coal extracted with chloroform gave 1·2 per cent. soluble. On heating another portion of the coal to 230° C. in inert gas for five hours, it gave on extraction 1·4 per cent. soluble in chloroform. A third portion, heated for five hours at 270° C., gave on extraction 7·6 per cent. soluble in chloroform. A fourth portion was alternately heated from 330° to 340° C. in inert gas, and extracted with chloroform five times. The total time of heating was 22 hours, and the total of the chloroform extracts amounted to 8½ per cent. on the original coal. It is evident that a subtle change starts in Arley coal at about 250° C., and at 270° C. it is very marked, although the coal is changed very slightly in appearance and no permanent gas appears to be evolved. Experiments were made to ascertain which part of the coal gave rise to these products soluble in chloroform. Pyridine extract after heating to 340° C. gave 8·2 per cent., and pyridine residue after similar treatment gave 1·6 per cent. It is therefore evident that both constituents give rise to the products.

Nitrogen in Coal.

There is evidence to show that nitrogen occurs in coal combined in two or more essentially different ways. A small quantity of the total is given off as ammonia on carbonization; while half of it remains in the coke, indicating that it occurs in coal combined in at least two different ways and probably more.

It has been observed that in some coals the amount of nitrogen estimated by the Kjeldahl method is a mere trace, when a Dumas estimation reveals the fact that there is about 2 per cent. In other coals the two methods give exactly the same amount—showing that the nitrogen is not held in a similar way in all coals. It has been further observed that, when some coals are mixed with caustic soda and ignited, much less nitrogen remains fixed in the residue after carbonization than in the residue of the untreated coal; and, on the contrary, it has been observed that other coals, when treated in a similar way with caustic soda, &c., had more of their nitrogen fixed than when heated alone.

Some of the fixed nitrogen can be converted into ammonia by passing hydrogen over the red-hot coke. But the only practical method hitherto devised of increasing the yield of ammonia is to burn the coke while keeping the temperature as low as possible, as in the Mond producers. The nitrogen which comes off as ammonia on the carbonization of coal probably exists in side-chain groups; while that which remains fixed in the coke probably occurs in ring compounds—the ring part being stable at a red heat.

More than twenty years ago, R. J. Friswell discovered that by acting on powdered coal with nitric acid of about 50 per cent. strength, a complex organic acid or acids were obtained which decomposed sodium carbonate, with evolution of carbon dioxide. These bodies, which were later called the "coal acids" by Anderson, are insoluble in water containing much mineral acid; but in pure water or dilute alkali or dilute acid they are soluble, giving an ink-like solution. The solid coal acids on heating with zinc dust gave hydrogen, cyanogen, and a small quantity of aqueous distillate, smelling of ammonia and pyridine, and containing hydrocyanic acid (Friswell).

Anderson worked on compounds made from different kinds of coals by treating with nitric acid, and found that the resulting coal acids had about the same ultimate chemical composition. It seemed probable that the nitric acid oxidized all the side-chains, giving COOH groups attached to a nitrogen ring complex. To test this, the author oxidized some Arley coal with fuming sulphuric acid (so as to keep nitrogen containing reagents out of the experiments), and obtained similar compounds to those got by Friswell and Anderson. The solid purified coal acid was mixed with caustic soda and heated. A gas smelling like charred albumen or bone was the result; and the same was obtained several times on repeating the experiment with fresh quantities of coal. This would appear to indicate that coal contains nitrogen in the form of a ring complex, which on oxidation with fuming sulphuric acid is converted into a carboxylic acridine.

"Coalite" and Other Processes.

The old and modern coalite processes were described by the author. In the modern process the coal is carbonized at about 650° C., with the result that the fuel is not so friable. The yield of sulphate is raised from 12 to 28 lbs., the tar is reduced to 18 gallons, and the gas increased to 8500 cubic feet per ton of an average bituminous coal. He also referred to low-temperature carbonization *in vacuo*, and pointed out that by this process as much as 80 to 100 gallons of coal oils were obtainable from certain cannel coals, a considerable portion (8 to 10 gallons) of which could be converted into petrol, and a large proportion of the remainder into oils suitable for use in Diesel engines. Another low-temperature carbonization process—viz., the "Del Monte"—was briefly mentioned.

These processes were not intended to replace either gas-works practice or the metallurgical coke-ovens; and the author questions whether, in view of the demand for a smokeless fuel and the great advance in the value of petrol and oil suitable for Diesel engines, the modern gas-works practice of obtaining as much gas as possible per ton of coal had not been overdone, and the old lower-temperature carbonization was not more suitable to present needs.

As regards metallurgical coke, it was also a question whether this could not be produced in two stages: (1) Carbonization at a sufficiently low temperature to preserve the valuable light oils and give rich gas; and (2) high temperature carbonization to give the finished hard coke and poor gas. Both the gas-works manager and the coke-oven manager could learn, from the study of big gob-fires, that, under certain conditions, it was not a question of how difficult it was to heat-up coal, but how difficult it was to prevent it heating-up spontaneously; also that a gob-fire could give a beautiful hard coke with hard coal which no existing coke-oven process could coke at all. Practically, any bituminous coal could be coked in favourable circumstances; but ordinary coke-oven processes do not give these favourable conditions.

RADIATORS WITH INCANDESCENT MANTLES.

At the Meeting of the Société Technique du Gaz en France held in Paris in 1912, M. Lucien Bertin submitted a paper on "Heating by Radiation," of which an abstract translation was given in the "Journal" at the time. The paper was considered of such value by the Committee of the Society that they awarded the author a prize of 400 frs. In their opinion, as expressed when making the award, it was the best communication presented at the meeting. They thought, however, that a suggestion thrown out some years ago by a former President of the Society—M. Th. Vautier—that the effect of using incandescent mantles should be investigated, still remained to be taken up. This has been done by M. Bertin, who records in the "Journal des Usines à Gaz" the results of his experiments. The following will give an indication of the scope of his article.

The author begins by remarking that the problem of heating by radiation would be definitely and completely solved if a body could be found capable of transforming all the energy contained in flames into radiations of great wave length, giving much heat and little light. Attempts in this direction have been numerous; but up to now the result has only been the production by the French Auer Company of the radiator constructed by them in accordance with the patents of M. Delage, which was brought under the notice of the members of the Société Technique at their meeting in Marseilles in 1911. The Committee reported specially upon the radiator, which they had had thoroughly tested. They considered that the application of the radio-activity of cerium to gas heating-stoves by means of incandescent mantles was the first successful instance of the utilization of the radiating properties peculiar to this body, and that the yields shown under the conditions of the experiment, and the low temperature of the gases emitted, constituted results which it was the duty of the Society to signalize and recompense. They accordingly awarded the Company a prize of 500 frs. M. Delage's invention constitutes a practical application of heating by radiation from cerite ($Ce_2 O_3$); and the development of the use of oxide of cerium for heating would, in M. Bertin's opinion, be of considerable industrial and economic interest, as it would present an outlet for a portion of the existing large stocks of the residues of the extraction of thorium from monazite sand.

Before giving the result of his experiments with a radiator fitted with mantles, M. Bertin summarizes the investigations of Rubens and Féry on the heat radiation of cerite. The former found that a mantle of this substance placed in the flame of a bunsen burner acquires a relatively low temperature (1350° C., or 2462° Fahr., absolute), while a thorine mantle, in similar condition, will acquire a very high one (1900° C., or 3452° Fahr., absolute), and an Auer mantle reaches 1800° C., or 3272° Fahr., absolute. M. Féry compared the calorific radiation of thorine, cerite, and the Auer mixture, and found it is much greater in a reducing flame (red colour) than in an oxidizing flame (greenish-blue colour). It is the contrary in the case of lime and thorine. In a reducing flame, the radiation is greater than that of the black bodies or the electric furnace for an equal temperature. M. Féry found that the calorific radiation of cerite attains its maximum intensity in the region of the blue flame where combustion is effected.

Remembering an experiment carried out by Mr. Westphall, M. Bertin heated some water in flasks placed above two exactly similar burners—one carrying an Auer (Plaissetty) mantle and the other a cerite (Delage) mantle. The temperature of the water in the former flask rose more quickly than in the latter; thereby proving that the combustion products were hotter. If, on the contrary, the flasks were placed at the sides of the mantles—say at

the distance of an inch—the water in the flask near the cerite mantle was heated more quickly; showing that more heat was being given off. The cerite mantle transformed into radiations a greater quantity of heat than the Auer mantle, and the combustion products were consequently not so hot.

M. Bertin measured with a Rubens thermopile the radiation from a 3·7 cubic feet burner under three conditions—viz., naked flame, capped with an Auer (Plaissetty) mantle, and then with a cerite mantle. The following are the results in degrees of the galvanometer: Naked flame, 2·5; Auer mantle, 5; cerite mantle, 8·5. All the conditions being the same, the calorific radiation of the cerite mantle is 70 per cent. greater than the Auer mantle.

The radiator devised by M. Delage, to which reference has been made, consists of a range of six high-power burners such as are used for lighting, capped with mantles of knitted asbestos specially made, for the first time, by the ingenious machines constructed by M. Ligneau de Seréville. By the aid of the thermopile and the radiation calorimeter, according to the modified method of Mr. E. W. Smith, M. Bertin investigated the radiating capabilities of M. Delage's appliance. The accompanying diagram (fig. 1) shows

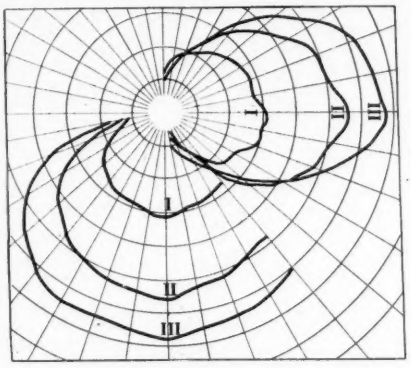


Fig. 1.

the vertical and horizontal rays obtained from it with a consumption of rather more than 27 cubic feet of gas. The curves marked I. represent the radiation from bunsen flames; while those marked II. and III. are the radiations from Auer (Plaissetty) and cerite (Delage) mantles respectively. Working normally, the yield of the radiator, fitted with asbestos-cerite mantles, was 91 per cent. higher than that given by the bunsen flames, and 23·25 per cent. higher than that of the Auer mantle. The actual radiation of the flames was 52 per cent. of the radiation of the cerite and 59 per cent. of that of the Auer mantle. The other diagram (fig. 2) gives the values of the central radiation of the Delage appliance, expressed in degrees of the galvanometer, from minute

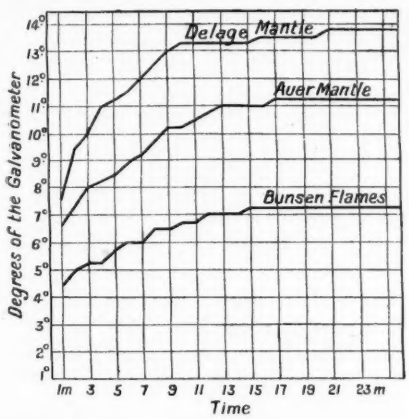


Fig. 2.

to minute, after lighting-up; the heating medium being Auer or Delage mantles or simply open flames. The temperature of the gases used, measured in the same way, was 179° C. (354° Fahr.) for the radiator fitted with cerite mantles and 197° (386° Fahr.) for the Auer mantles. M. Bertin says the result corresponds very well with the water-heating trial already referred to, and shows that, from the calorific point of view, cerite is a much better agent for the transformation of energy than the Auer mixture. Besides, the red colouring of the mantles indicates that they are well immersed in the zone of flame where radiation is most intense.

Recent Wills.—Alderman Charles Nathaniel Brown, J.P., the Chairman and Secretary of the Gorleston and Southtown Gas Company, whose death was recorded in the "JOURNAL" for the 10th of March, left estate valued at £97,200 gross, with £82,532 net personalty. Alderman James Batten Winterbotham, one of the Directors of the Cheltenham Gas Company, whose death at Luxor, Egypt, was announced in the "JOURNAL" for the 31st of March, left £90,905 gross and £82,006 net.

PURIFICATION OF BLAST-FURNACE GAS.

Dry v. Wet Cleaning.

At the Annual Meeting of the Iron and Steel Institute, a paper on "The Development of Dry Cleaning in Blast-Furnace Gas Purification" was submitted by Herr FRITZ MÜLLER, of Brebach (Prussia). As the gas in question is used for driving engines, the following extracts from the communication, with some of the remarks made upon it, may not be without interest to readers of the "JOURNAL."

At the International Congress of Mining, Metallurgy, Applied Mechanics, and Practical Geology held in Düsseldorf in 1910, there was a paper dealing with the cleaning of blast-furnace gases. In the subsequent discussion, the author of the present paper drew for the first time the attention of the metallurgical world to the results obtained by the practical application of a new dry process of cleaning gas, which was first carried out in a large experimental plant, dealing with 175,000 cubic feet of gas an hour, at Brebach, near Saarbrücken. Since then a great number of industrial installations, including many of very large capacity, have been erected and put into operation, and others are in course of erection.

The gas coming from the blast-furnace contains from 10 to 20 grammes of dust per cubic metre; the heaviest particles of which, and therefore the richest in iron, separate first, and are deposited in big dust-catchers or mains, from which the accumulations can easily be drawn off while working. On its way to the cleaners, the crude gas is cooled down approximately to the dew-point in a surface cooler placed in front of them. After passing the cooler, the crude gas, which still contains more than 5 grammes of dust, is led through a superheater, where, by means of steam or burnt waste gases, its temperature is raised by some 10° to 20° C. The superheated gas then rises through a distributing-pipe into a system of filter-boxes. In the different chambers, which can be shut off from one another independently, filter-bags made of special cloth are suspended. The crude gas is drawn by exhaust fans into the interior and through the cloth of the bags, to the inside of which the dust remains clinging. The cleaned gas is passed straight on by the fans to its destination without any further treatment, except that the gas used for driving gas-engines must first be water-cooled.

After passing the filter chambers, the gas generally contains about 3·5 milligrammes of dust per cubic metre. This falls below 1 milligramme when the gas is cooled down with water. No water is injected into the fan, and the latter has therefore only to overcome the resistance of the filter-bags. Consequently its power consumption is far lower than that of corresponding fans in wet-cleaning processes. Tests carried out by Professor F. Mayer, of Aix-la-Chapelle, on the plant at Brebach show that for the actual cleaning process the power consumption is 1·91 H.P. per 1000 cubic metres of cleaned gas at 0° C. and 3 inches of mercury. For an increase in pressure corresponding to 4 inches water-gauge, the power consumption increases by 0·81 H.P. per 1000 cubic metres of gas. Very striking was the difference in power consumption of a large new plant in the Minette district compared with that of a wet-cleaning plant it replaced. The latter plant for gas-engines required 350 H.P., which dropped to 70 H.P. when starting the dry-cleaning plant. The quantity and pressure of gas were the same in both cases; while the dust content of the gas fell to 2·5 to 1 milligramme per cubic metre of gas.

Naturally a dry-cleaning plant cannot be cheaper, as to first cost, than a wet-cleaning plant. The first cost is somewhere about £175 per 1000 cubic metres of gas; but trials are in progress which will result in a considerable reduction by increasing the capacity and simplifying the mechanism of the plant. On the other hand, the dry-cleaning plant has the advantage of low working costs, which are about 1d. to 1¼d. per 1000 cubic metres of cleaned gas, exclusive of redemption and interest; the power being reckoned at 0·375d. per kilowatt-hour.

The advantages of highly cleaned gas are well known to all specialists. They are most apparent in gas-engines, since by employing a gas of great purity a far higher degree of safety in working is assured. Stoppages are reduced to a minimum; thus reducing the cost for cleaning, repairs to cylinders, pistons, and stuffing-boxes. A comparison, made on a gas-engine plant of 5000 H.P., shows that since the introduction of the dry-cleaning process only about one-fourth of the former stoppages are necessary; whereas the cost for repairs and cleaning are about one-fifth to one-sixth as against working with wet-cleaned gas. Calculated on the horse power, the gain was about 2s. 7d. per year. Further advantages are that misfires and early ignitions are practically done away with, and cheaper lubricating oils can be used. In a large steel-works on the Rhine, where the crude gas pressure is extraordinarily high (up to 24 inches water-gauge), it is possible to convey the gas to the engines without the aid of any fan and without final cooling. The gas reaches the engines at a temperature of about 40° C.

Opinions are divided as to the advantages of the highly cleaned gas with boilers. Generally it is taken that primary cleaned gas with about 0·5 gramme per cubic metre is perfectly sufficient. It is explicitly admitted, however, that this primary cleaned gas gives better results than the crude gas; and therefore there is no doubt that the results will be still further improved by burning

highly cleaned gas, which it is possible to obtain at a lower cost than the less perfectly cleaned gas.

Since the introduction of the new cleaning process three years ago, the interest shown by blast-furnace men has constantly increased. Several plants of a capacity of 240,000 to 300,000 cubic metres are now in course of construction in the Saar and Westphalian districts.

DISCUSSION.

Mr. GREVILLE T. JONES said that, after very careful consideration of the question of cleaning gas, it was decided to put down at the Clarence Iron-Works, Middlesbrough, a small experimental plant on the system mentioned in the paper. It was really intended for the use of the blast-furnace gases in the steel-works; and it only dealt with 10,000 cubic metres of gas per hour. The gas travelled to the works in a 3-feet tube over a distance of 476 yards. As it left the blast-furnace, after passing through dust-catchers, it contained from 5 to 6 grammes of impalpable powder; along the tube it lost about a gramme; and after passing through the bags the dust in the gas did not exceed 0·15 per cent. The cost of cleaning was slightly under 2d. per 1000 cubic metres. With regard to the use of this plant for cleaning gas for stoves and boilers, he doubted very much whether it would pay any firm in the North of England to instal it when the capital cost was taken into account; but if he was putting up a large installation and introducing gas-engines, he would have no hesitation in employing dry-cleaning rather than wet-cleaning plant.

Mr. WALTER DIXON said everybody was agreed that blast-furnace gas should be cleaned. If the gas was required for engine purposes, it must be, as far as possible, perfectly clean; and the question of whether it was dry-cleaned or wet-cleaned was one of the particular circumstances. Dry-cleaning, so far as we in this country were concerned, obviously offered a good many advantages. He had been interested in the dust question for a good many years, and had attacked the problem from another point of view. The last ten years had been occupied in finding out how to clean gas; but he had endeavoured to see if he could cure the disease by preventing dust being in the gas. During the past year he had obtained satisfactory results—in other words, he had been able to employ, without any particular expense, certain types of blast-furnace so as to have a gas with so little dust that he could get practically all the results, as far as the boilers were concerned, that were obtained when a gas-cleaning plant was installed.

Mr. E. HALL BROWN said he felt that the comparison which had been instituted in the paper between the dry-cleaning system at Brebach and the wet-cleaning systems was hardly fair to the latter. As there were few installations of dry-cleaning plant in this country, he would like to be permitted to refer to the report of the investigations of Professor F. Mayer, which was mentioned by the author of the paper as a typical example of the system. In this report (published in "Stahl und Eisen"), Professor Mayer stated that the raw gas reached the dry gas cleaning plant at very variable temperatures, sometimes only about 50° C., when it was saturated with moisture, rising on occasions to 200° C. These were moderate temperatures, and might account for the fact that the cooling of the gas, as distinct from the cleaning, occupied so small a part in Herr Müller's paper. At the present time, whether blast-furnace gas was cleaned by the dry or the wet process, it was necessary that the crude gas should be cooled from the temperature at which it left the furnace to one suitable for the cleaning plant. The system of cooling adopted in each special case might be entirely determined by the same considerations, whether dry or wet cleaning was chosen; and the results would be the same in each case. He should be exceedingly glad if the author would state what surface would be required to cool 100,000 cubic metres of standard gas from 500° C. to (say) 50° C. in summer weather. Turning to the question of cleaning, with regard to the degree of cleanliness attained he had to admit that, on the evidence of Professor Mayer, the dry system produced cleaner gas than any system of wet cleaning with which he was acquainted. What did this amount to? With a Theisen washer or disintegrator the dust content of blast-furnace gas could easily be reduced to 0·015 gramme per cubic metre, which was said to be better than the air of Middlesbrough. Was there any need to make the gas purer than the air with which it was burnt? He could point to six and nine months' continuous non-stop runs with engines using gas cleaned by Theisen washers, which showed very little accumulation of any kind within the valve-chests or the cylinders. He could not conceive that purer gas was necessary. If it could be obtained with the same certainty and cheapness as gas cleaned by the Theisen process, there would be no objection to the extra cleanness; but this was all that could be said regarding it. It was claimed by the author that the power needed for the dry-cleaning system was much less than that required by any wet-cleaning system; but he could not accept the figures given in the paper as representing a correct comparison. He admitted that on the Continent the applications of dry and wet cleaning seemed to be fairly divided, and both systems had their advocates and their successful applications. While he was fairly satisfied with the results at present obtained in the purification of blast-furnace gas for use in engines, he was of opinion that none of the present systems of gas purification exactly met the case of gas cleaning for boilers and stoves. The degree of purity attained was, of course, quite satisfactory; but no one could justify the enormous waste of heat entailed by the cooling of the gas as a necessary preliminary to its purification. He was convinced that sufficiently pure gas could be produced for these purposes without the sacrifice of the sensible heat which the gas contained when it left the furnace. He believed that the conditions to be fulfilled by gas-cleaning plants in this country could in most cases be met by wet-cleaning plant, which, among other advantages, had undoubtedly that of less first cost than plant on the dry-cleaning system, and had the undoubted merit of long and successful trial.

REMOVAL OF NAPHTHALENE FROM WATER-GAS.

A Home-Made Washer.

At the last meeting of the New England Association of Gas Engineers, Mr. WYANT gave some particulars in regard to the working of what he called a "home-made" washer in use upon his works. The subject arose on an inquiry in the "Question-Box" as to the causes of, and remedies for, naphthalene in water-gas plants. Mr. Wyant said: The washer consists of an old tubular condenser shell from which the tubes were all cut out. The shell is about 6 ft. 6 in. diameter, and 20 feet long, and stands on end, with the gas intake at the bottom and the outlet at the top. Between the inlet and outlet it is filled with wood grids, to a point about 2 feet from the take-off, where there is an open space 1 foot high, with another series of wood grids 1 foot thick above the space. We introduce hot oil tar into the space near the top of the scrubber, letting it run down over the grids. At the bottom it passes out through a sealed drip, and runs back to the collecting-tank. As a reservoir for the oil tar, we have a large brick tank, into which the overflow from the seals in the water-gas plant runs, and with it the tar from the seals and hot water-gas scrubbers. We always keep a considerable quantity of oil tar in the bottom of this brick tank. The temperature there is maintained automatically. It is very essential in naphthalene washing to maintain the temperature of the washing tar well above 100° Fahr., in order to avoid washing out the illuminants in the coal gas; and this arrangement takes care of the heating of the tar without trouble or thought. As to the quantity of tar used, it requires only ¼-H.P. motor to pump a large stream; and we therefore run a large excess of this hot oil tar through the scrubber—about 8 gallons per 1000 cubic feet of coal gas.

Mr. M'QUESTON asked Mr. Wyant if by his process he got naphthalene out of his distributing system or simply relieved his works. He said he put the question because he had lately seen an article by a German writer in which it was stated that scrubbing with water-gas tar would relieve the works from naphthalene, but would not keep it out of the distributing system.

Mr. KENNEDY asked as to the temperature of the gas when the tar struck it.

Mr. WYANT said that it was 110° Fahr. The tar entered the scrubbers at 110° Fahr.—*i.e.*, the temperature of the incoming gas. He further explained that the gas was passed from the retort-house into primary condensers, from there through the exhausters, then through an immersion washer, and from the washer through the naphthalene scrubber and on to the secondary condensers. Immediately after leaving the washer the temperature was reduced to 70° Fahr. If they shut off the naphthalene scrubber, they found it necessary to steam and wash-out the secondary condensers about every five days. With the scrubber in operation, the necessity for cleaning the condensers was practically eliminated.

Mr. KENNEDY remarked that it would be interesting if anyone using the rotary scrubber would give the results obtained. He said he had heard that some managers had freed their works but had deluged the distributing system.

Mr. M'QUESTON said he was using at Lawrence a rotary scrubber located in a position similar to Mr. Wyant's, or immediately after the tar-extractor—the gas entering at a temperature of about 100° Fahr. They found it had been quite efficient, for there were now no signs of naphthalene at the works, whereas previously they had considerable trouble.

Mr. WYANT said he found that long contact was necessary in order to absorb the naphthalene. He had not mentioned the purpose of placing the small section of grids above the inlet of the tar. The gas was, of course, passing through the grids very rapidly; and, unless there was something to prevent it, the oil tar was likely to be picked up and carried away with the gas, so that it would contaminate the liquor in the condensers. They also introduced the tar as smoothly as possible, and for the like purpose avoided any spraying action.

Gas-Engines for Electric Light Production.—The May "Bulletin" of the British Commercial Gas Association contains two interesting special articles entitled "Some Notes on the Generation of Electricity by Gas-Engine Driven Dynamos for Cinema Theatres and Other Establishments Using Considerable Quantities of Current." One is by Mr. A. E. Broadberry, M.Inst.C.E., the Engineer of the Tottenham District Light, Heat, and Power Company; the other by Mr. Robert Watson, the Engineer of the Doncaster Corporation Gas-Works. Mr. Watson's article is followed by a suggested draft letter for circularizing managers of theatres and picture palaces on the subject of generating electricity by gas-engines. As the Editor of the "Bulletin" remarks, "the letter and the statistics given should prove of immense practical use."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Unfair Electrical Competition and the Long Eaton Judgment.

SIR,—I have no doubt in your forthcoming issue you will be referring to the judgment of Mr. Justice Sargant in the Long Eaton case. The judgment is such a clear and lucid one that I hope it may be thought worthy of more prominent type and position in your columns than if it is partly hidden away under the heading of "Legal Intelligence."

Gas undertakings almost everywhere have been suffering from the unfair competition of suppliers of electrical energy, who have made special terms with the consumer who is able to hold his own with them, while the ordinary user of current has had to be content with paying a very high price. Parliament certainly never intended that statutory powers should be used in such a manner; and Mr. Justice Sargant's judgment is most helpful in that it places before the suppliers of energy—whether in the form of gas or electricity—the true conditions under which they are empowered to carry on business.

I hope you will allow me to add that, in my opinion, the gas industry is very greatly indebted to the Long Eaton Company for fighting this case; and especially Mr. Stevenson, their Engineer, who stuck to his guns in a fight which would have disheartened many other men, and to his Chairman who has so whole-heartedly backed up his endeavours.

CHARLES CARPENTER.

South Metropolitan Gas Company,
709, Old Kent Road, S.E., May 13, 1914.

[Our correspondent's letter came to hand after the judgment had been put in type for our "Legal Intelligence." But we think that compensation for the fact that it is not in more prominent type than is usually given to legal reports will be found in the fact that the critical, penetrating, and far-reaching judgment is reported *in extenso* in our pages. Supplementing this fact, our correspondent's letter and our first editorial this week will assist in accentuating the importance of the judicial deliverance (if such accentuation be needed) in the eyes of the two industries concerned.—ED. J.G.L.]

Analyses of Coal and Other Gases.

SIR,—On p. 425 of your issue of May 12, there appears a brief description by Messrs. Sinnatt and Cramer of a method for the estimation of carbon monoxide. The process described involves the oxidation of this gas by iodine pentoxide, and the determination of the carbon dioxide produced by its absorption in baryta, and subsequent back-titration. The writer would like to draw attention to the fact that an apparatus for the estimation of carbon monoxide, in which these reactions are employed in this manner, was described in a paper by him read before the Society of Chemical Industry in December, 1912, an account of which subsequently appeared in the "JOURNAL." The apparatus is suitable (with but slight modifications) for the determination of any quantity of carbon monoxide. It may further be added that this reaction, when carried out in the way devised by the writer, is so rapid and complete that it has now been adopted for the construction of an automatic carbon monoxide recorder.

No doubt Messrs. Sinnatt and Cramer overlooked these facts in their historical summary—particularly as the apparatus was the first to be put to practical use in considerable numbers.

The writer would also venture a remark upon the contents of Mr. Gray's letter on p. 433 of the same issue. In this communication attention is drawn to the inaccuracies occasioned in the results of an explosion analysis owing to the presence of homologues of methane. The writer is quite in agreement with Mr. Gray, and would add that this is by no means the only inaccuracy and difficulty attendant upon the analysis of combustible gases by the explosion method. These difficulties do not arise if other methods of estimating the inflammable gases be adopted. For instance, the errors are entirely avoided if the copper oxide method of analysis, perfected by Mr. Taplay, is employed. They are also impossible in analyses which are carried out with the writer's silica platinum combustion capillary.

For these and other reasons which the writer has at various times fully stated in your columns, he is of the opinion that the explosion method of analysis should be finally discarded in favour of the more modern and accurate methods which have now been developed. He makes this communication, lest from Mr. Gray's letter it might be inferred that this important aspect of gas analysis had not previously been put before its readers by the "JOURNAL."

LEONARD A. LEVY,
M.A.(Cantab.), D.Sc.(Lond.), F.I.C.

1, Westminster Palace Gardens,
May 13, 1914.

Meters Registering Fast.

SIR,—I am venturing to address you upon a subject which is causing me a certain amount of uneasiness at the present time. At my works, which have an output of about 50 millions per annum, a second-hand carburetted water-gas plant has been in use for some years; but the proportion of water gas used is not large. It is seldom the maximum would exceed about 30 per cent.

We now seem to have general dissatisfaction among the consumers, whose accounts are said to be continually increasing, without, as they allege, there being any increased use of gas or of the work done by it. When dealing with the cases of dispute as they arise, and the meter comes to be tested, it is found in the majority of instances to register fast. This is a new experience with us. On investigation, nothing can be found in the condition of the meters which will account for their going fast, though in some instances the leather diaphragms are stated to be saturated with moisture, and in others very dry. We are taking steps to obtain a calorimeter for testing the heating power of the gas. Does any reader know of a similar state of things; and, if so, what would be the best thing to do?

I may say the illuminating power of the gas is 17 to 18 candles. The condensing and washing plant is not efficient, inasmuch as on the outlet of the washer, before the gas enters the purifiers, there is found on an average at the present time about 18 grains of ammonia per 100 cubic feet. This is nearly all taken out by the purifiers, as only about ½ grain per 100 feet is found on the outlet of the purifiers. There are four purifiers charged with oxide of iron, with about 2 per cent. of air drawn through to assist the purification; and the fifth purifier, which always comes last, is charged with lime.

DOUBTFUL.

May 15, 1914.

Station Meter Construction.

SIR,—The article entitled "The Principles and Functions of a Station Meter," in your issue of April 14, contains a statement which I do not consider should pass unnoticed.

At the bottom of col. 1, p. 108, reference is made to the alteration in volume of gas with temperature; and I think if Mr. Parsons will read over his statement, he will find that the correction for temperature would have the effect of making the true reading of the station-meter 99·5 cubic feet, which is $\frac{99·5}{98·5}$ or 1·01 per cent. fast.

W. C. GOODCHILD.

Derby, May 14, 1914.

The Duties of Gas Collectors.

SIR,—Will you allow me to make a few comments on the discussion at the recent Redhill Conference of the "B. C. G. A.," with regard to the duties of a collector?

It is, I should think, the first occasion on which that official has been "under fire" at a meeting of this description; and it would be interesting if an opportunity were given at a future conference for a collector to give his views on the subject.

The opinions of Mr. Goodenough and others (gentlemen who stand high in their profession), that the collector is a valuable asset to his undertaking as a "business getter," should induce the management of many companies to take more advantage of this help than has hitherto been the case. That the majority of undertakings fail to make full use of this and other opportunities to increase their business, is plainly evident from the remarks of several of the speakers. This neglect is responsible for the unfortunate official to whom Mr. Head applied the homely description of "stick-in-the-mud," though, on reflection, he will probably agree that he was implicating not only the official—be he collector or clerk—but also the management which permitted the officer to become a "stick-in-the-mud."

It is generally recognized that, in business, the staff will reflect the attitude of those over them. Wastrels and "don't cares" are to be found in all business concerns—gas companies included. But an alert and enterprising management will, as a rule, meet with a ready response from their staff, and *vice versa*.

Given the keen co-operation and encouragement of his superiors, the collector will be found ready and willing to use his utmost endeavour for the success of the company with whom he is connected; but without these incentives, he will drift into that state of *laissez faire* which at present is the worst foe the gas industry has to overcome.

Let those who have the direction of gas companies be ever ready to encourage initiative and enterprise in their staff, and one will then hear less of "stick-in-the-mud" officials, and more of the progress of our industry.

VERITAS.

May 16, 1914.

The Bradford Gas Show-Room.

At a meeting of the Bradford Chamber of Trade, reference was made to the proposal of the Bradford Gas Committee to open an extensive show-room in the principal shopping street of the city. The President (Mr. G. Brown) said that, though the Chamber of Trade, and the plumbers' and gas and electricity engineers' organizations, had gained a point by securing modifications of the original scheme, in obtaining an undertaking that no sales of goods in competition with private traders would take place in the new show-room, they must still remember that the scheme was, in their opinion, unnecessarily costly. The proposal would cost the ratepayers £1000 a year; and it seemed to the traders that equally good results could have been obtained by premises in a side street at much smaller expense. Mr. T. Pratt said he had been a member of the deputation which had secured the undertaking from the Gas Committee; and he wished to urge that this matter should not be lost sight of, because it was significant that the Chairman of the Gas Committee had definitely declined to commit the Corporation to any undertaking beyond the period of his own term of office. Therefore it was not likely that the private traders were yet "out of the wood."

New Electricity Works at Walsall.—With the proviso that use shall be made of certain modern plant at the existing works, the Walsall Town Council have agreed to a recommendation of the Electricity Committee that plans and estimates prepared by the Consulting Electrical Engineer (Mr. E. M. Lacey) for the provision of a new electricity generating station at Birchills be approved, and that application be made to the Local Government Board for sanction to the borrowing of £74,850 to defray the cost, including the necessary mains and auxiliary apparatus. The Committee had been advised that their present system was obsolete, and the site of the works was unsuitable; and this, they said, left them with no alternative but to erect and equip a new power station. One member said the scheme should have been undertaken years ago, and that the outlay proposed was the minimum amount which would place the electricity undertaking in a sound position.

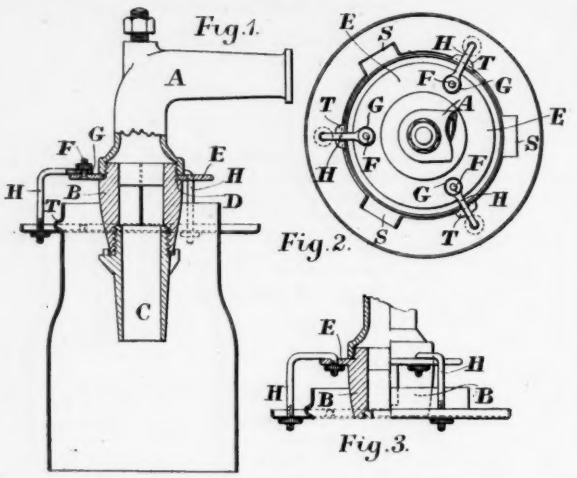
REGISTER OF PATENTS.

Inverted Incandescent Gas-Burners.

PODMORE, A. E., of Herne Hill, S.E.

No. 9252; April 19, 1913.

This invention has principally for its object to provide means for deflecting heat downwards away from the burner tube and the upper parts of the burner, "so that the temperature at or near the mantle shall be greater than usual and the light intensified."



Podmore's Inverted Incandescent Burners.

The construction shown in figs. 1 and 2 is of the bent-tube type. The lower end of the burner tube A is formed as an internally screw-threaded socket for receiving the screw-threaded nose piece B of the burner. This is internally screw-threaded to receive the upper end of the nozzle C, which supports the mantle. A shoulder D, formed just below the upper end of the nose piece, serves to support an annular deflector plate E clamped between the flange D and the lower end of the burner tube. At about midway between its inner and outer peripheries this metal or earthenware plate is provided at different points with upwardly projecting screw-threaded studs F, for receiving the forked or perforated ends G of radially extending arms H, which are bent downwardly at their outer ends. Preferably there are three such arms (arranged at 120° from each other) and a corresponding number of studs provided on the deflector plate. The arms carry a ring of enamelled material, which serves to support an inner glass cylinder round the burner. The ring is provided on its inner periphery with a number of radially extending slots S to allow of the passage of projections T in bayonet fashion.

In the case of lamps having groups of burners, each burner has a separate ring for supporting an inner glass cylinder, so that any burner ring can be removed and replaced without disturbing the other burners. An outer glass globe encloses the whole cluster.

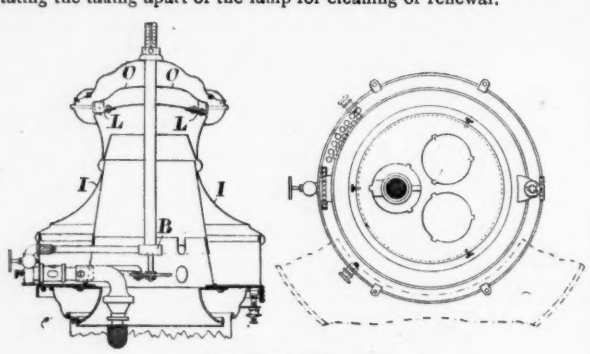
In the modified arrangement shown in fig. 3, the nose piece B and deflector plate E are made in one piece, or integrally with each other, and the deflector plate is perforated to allow of the passage of the inner bent ends of the radial arms H, which are secured to the deflector plate by nuts or the like.

Gas-Lamps.

PODMORE, A. E., of Herne Hill, S.E.

No. 9253; April 19, 1913.

This gas-lamp comprises an annular chamber (surrounding a central chimney) in which the air inlets of the burners are located, and in which the foundation plate of the annular chamber extends partly within and partly outside the circle representing the top edge of the globe or globe-supporting ring or corona, and is detachable for facilitating the taking apart of the lamp for cleaning or renewal.



Podmore's Gas-Lamps.

According to one construction the lamp is suspended from a central supply pipe terminating in a central main gas-box B, from which radiate branch supply pipes extending through slots in the upper and lower metal chimney sections and through the lower cylindrical wall of the outer casing or body. The upper chimney section has slots extending upwards from its lower edge; while the lower chimney section has the slots extending downwards from its upper edge. The intermediate portion I of the casing has a downwardly projecting flange covering the junction with the lower wall, and it rests on it. It is open at the top, and has an internally projecting flange L and a centrally perforated loose iron protector or bell O above. The top of the casing is a centrally perforated cap having fixed to it a wind guard, which extends below the top of the intermediate casing part I and above the cap—thus allowing egress of the products of combustion, while also preventing the entry of rain and draughts to the interior.

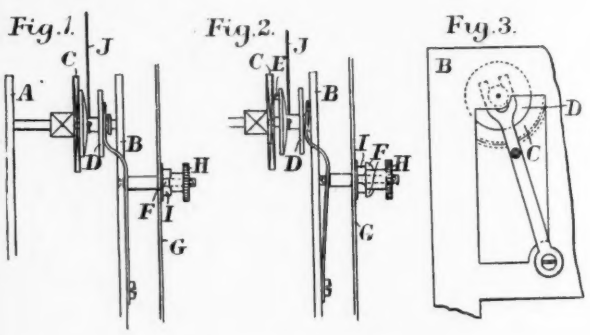
The tap or gas cock for each burner is formed in the middle of a U-bend or double elbow piece outside of the lower wall of the casing, and connected at one end to a radial branch supply pipe; the other end being connected to the air or mixing chamber of the burner within the casing. The wall of the latter is perforated at two places for the passage of the connections from the radial branch pipe and to the air-chamber of each burner.

Controlling a Source of Light.

EISNER, S., of Whitechapel, E.

No. 3252; Feb. 7, 1914.

In clockwork mechanism employed for the purposes of this invention, a drum is loosely mounted upon the arbor of one of the wheels of the train actuated by an additional spring, and is arranged in such a way that it is normally locked to the wheel and rotates with them when the train is set in motion; the rotary motion causing the actuation of a cord connected (either directly or indirectly) with the light controlling means (the tap) and the extinguishing or lighting up of the source of illumination.



Eisner's Light Controller.

Fig. 1 shows the invention in its operative position. Fig. 2 shows the arrangements in their inoperative position. Fig. 3 is a view at right angles (certain parts being omitted).

A and B are plates between which the clockwork mechanism is mounted; and C is a wheel in the train actuated by an additional spring (not shown). D is a drum loosely mounted on the arbor; and on the side remote from the wheel it is provided with a grooved collar. Holes are pierced in the wheel so that the pin can enter any one of them. A spring is secured at one end to the plate B. The other end of the spring is forked, and engages the grooved collar and tends to push the drum towards the wheel. If the pin is in alignment with one of the holes in the wheel, the spring will force the pin into the hole and retain it there; otherwise it will, when the wheel rotates, be forced into a hole as soon as one comes into alignment with it. The drum and wheel are thus locked together and rotate as one when the train to which the wheel belongs is in motion.

When the drum is in its operative position, the lugs F engage diametrically arranged slots in a boss or projection G on the casing enclosing the clockwork mechanism. But when it is desired to render the drum inoperative without interfering with the motion of the train actuated by the additional spring, the knob or handle H is pulled so that the lugs come out of engagement with the slots, and then give a quarter turn so that the lugs rest upon the face of the boss I (see fig. 2). This operation causes the spring to pull the drum out of engagement with the wheel C. J is a connector secured at one end to the drum D; while the other end is attached, directly or indirectly, to the lever of the burner. With the parts in the position shown in fig. 1 the connector will be wound on the drum at the predetermined time when the train to which the wheel C belongs is put in motion; and as the connector is wound on the drum, it will actuate the gas-cock and cause the lamp to light up or go out as the case may be.

Continuous Distillation of Tar, &c.

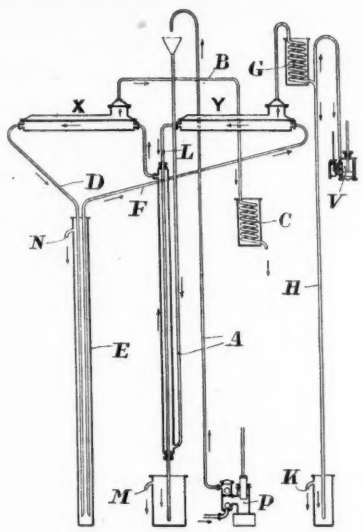
RASCHIG, F., of Ludwigshafen, Germany.

No. 14,230; June 19, 1913. Convention date, Oct. 26, 1912.

Hitherto, the patentee remarks, the continuous distillation of tar has been effected either by causing it to flow in a regular stream through a series of stills heated to different temperatures—each still yielding a higher boiling fraction of the distillate than the immediately preceding one—or else by causing it to flow through a single apparatus distilling off all vaporizable matter, and condensing this fractionally in different coolers arranged in series. The former method has the defect, he continues, that the heating must be very carefully watched. If it fluctuates, great irregularities occur as regards the quantity and the boiling point of the individual distillates and of the residual oil flowing

off. Heating to a given temperature automatically by steam under pressure is impracticable, because a different pressure of steam would be required for each individual apparatus, and also because even the highest steam pressure available for such purposes—say, a pressure of twenty atmospheres—would not yield sufficiently high temperatures. The second method has the same defects, and, in addition, the inconvenience that a fractional condensation of the vapours requires also a very accurate adjustment of the quantities of cooling water.

The present invention employs a series of stills, kept at substantially equal temperatures, in which a progressive distillation process is obtained by causing each apparatus (after the first) to work at a higher vacuum than the immediately preceding one. In its simplest form the apparatus consists of two stills, of which the first works at ordinary pressure and the second at a vacuum as high as possible. Both stills are heated by steam under pressure.



Raschig's Continuous Tar Still.

The illustration shows apparatus embodying the invention. Here a pump P supplies the tar in the shape of a uniform stream through the pipe conduit A to the first still X. Here the constituents of the tar, which have a relatively low boiling point—such as ammonia, benzene, toluene and water—are separated and escape through the pipe B into the cooler C, where they are condensed. The residual tar flows through the pipe D into the intermediate or compensating receptacle E, which has a height of 10 metres. From this the second still, in which a vacuum is constantly maintained by an air-pump V, the tar is drawn automatically through the pipe F at least 11 metres long, and this exactly in the quantity in which it is supplied to the intermediate receptacle E. In the still Y, the tar, being at a lower pressure than the atmosphere, loses its higher boiling constituents—such as naphthalene, carbolic oil, and creosote oil—which are condensed in the cooler G and flow out freely at K through the descending pipe H, 11 metres long. The residual tar escapes at L, and serves to preheat the crude tar flowing towards the apparatus X in the opposite direction, and is thereby cooled down to such an extent, that it may be allowed to escape at M into the atmosphere.

The plant is said to require hardly any supervision. It works quite automatically as long as the tar-pump and the vacuum-pump are working regularly. If for any reason the vacuum-pump stops, the still Y is gradually filled with air, and ceases to distil and to draw in tar. In such a case the intermediate vessel E fills with tar, and an overflow N discharges the tar back into the tar pit, which tar has been relieved only of its volatile constituents by the apparatus X. If the tar-pump once stops work, the distillation ceases in both stills, but recommences automatically as soon as the disturbing cause has been removed. It can never occur, as is easily the case in apparatus of the known type mentioned above, that apparatus X supplies the distillate expected from apparatus Y, and *vice versa*.

If it is desired to collect more than two fractions, one or more stills are inserted between the two stills described, and suitable reducing valves are arranged, to ensure that the vacuum gradually increases from still to still. In all cases only the residual liquor from the last still is utilized for preheating the material flowing into the first one.

Gas-Regulators.

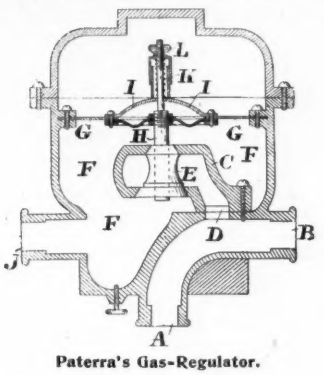
PATERRA, A., of Rome.

No. 9380; April 21, 1913. Convention date, April 22, 1912.

This fluid-pressure regulator is "designed more especially for use in connection with a gas-pipe in which the regulating action is set up through the agency of a diaphragm or a membrane secured to the valve and exposed to the action of fluid-pressure, so that the passage through the valve will be more or less closed or opened when the gas pressure increases or diminishes."

In the arrangement shown, A and B are gas inlets arranged respectively in vertical and horizontal position. Fastened within the outer casing is a second housing C with a channel D connecting them for the gas to pass to the double-seated valve E. F is the chamber to which the gas is admitted. G is a partition having a cushion hole closed by an india-rubber diaphragm fastened to the valve stem H. I is a cap covering the diaphragm. J is the gas outlet.

The gas enters through one of the inlets A or B, and passes, through the channel D and the passages left by the valve E when in its open position, into the chamber F. As the gas consumption diminishes, the pressure in F increases, and thus presses on the diaphragm and causes it to raise the valve towards its closing position and throttle the gas supply to the chamber. When the consumption increases, the pressure on the diaphragm will diminish and the valve will be caused, either by its own weight only or by some suitably arranged means, to drop back into its open position to such an extent that the pressure in the chamber F will again reach the required level.



Paterra's Gas-Regulator.

The required pressure in F may be regulated through adjustment of the spring K. By screwing down the knob L on the valve stem H, the spring will be shortened and its compression will co-operate with the gas pressure; so that a smaller pressure will be required to displace the valve towards its closing position. When, however, the knob is screwed upwards, the spring slackens, and its compression being diminished, it co-operates less with the pressure, and a higher pressure will be required for driving the valve towards its closing position.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS PROGRESS.

The following progress was made with Private Bills:—

The Market Rasen Water Bill was brought from the Commons, read the first time, and referred to the Examiners.

The Clydebank and District Water Order Confirmation Bill was brought from the Commons, read the first time, deemed to have been read a second time, and reported from the Committee.

The Middlesbrough Corporation Bill, Deal and Walmer Gas and Electricity Bill, and St. Anne's-on-the-Sea Improvement Bill were read a second time and committed.

The Hightown Gas and Electric Bill and the Chelmsford Gas Bill were reported with amendments.

The Local Government Provisional Orders (No. 2) Bill was reported without amendment, and subsequently read the third time and passed.

The Reading Corporation Bill, Liverpool Gas Company Bill, and Bristol Water Bill were read the third time and passed.

A petition has been presented by the Sandwich, Deal, and Walmer Electricity Supply Company against the Deal and Walmer Gas and Electricity Bill.

The Ashington Urban District Council Bill and the Kidsgrove Gas Bill were referred to a Select Committee consisting of Lord Lamington (Chairman), Earl Malmesbury, Lord Monteagle, Lord Erskine, and Lord Farrar.

HOUSE OF COMMONS PROGRESS.

The Reading Corporation Bill, Liverpool Gas Company Bill, and Bristol Water Bill were read the first time and referred to the Examiners.

The Ellesmere Port and Whitby Urban District Council Bill, Gas Provisional Order (No. 2) Bill, Brentford Gas Bill, and Local Government Provisional Orders (Gas) Bill were read a second time and committed.

The Walsall Corporation Bill, Whitwell and District Gas Bill, Mexborough Urban District Council Bill, and Stone Gas and Electricity Bill were reported with amendments.

The South Bank and Normanby Gas Company Bill, Clydebank and District Water Order Confirmation Bill, Tees Valley Water Bill, and Isle of Thanet Gas Bill were read the third time and passed.

A petition has been presented by the Hayward's Heath District Gas Company against the Gas Provisional Order (No. 2) Bill.

The petitions have been withdrawn of the Great Western Railway Company against the Newport Corporation Bill, the Yorkshire Electric Power Company and the Duke of Norfolk against the Sheffield Corporation Bill, W. H. Marsden and J. K. Marsden against the Northwich Urban District Council Bill, and the Cuckfield Rural District Council against the Hayward's Heath Gas Bill.

PIPE PROTECTION CLAUSES.

The pipe clause which has already been inserted in the Rhondda, North Eastern, and Hull and Barnsley Railway Bills [see "JOURNAL" for April 28, p. 274], also appears in the Great Northern, Great Western, and Midland Railway Bills, which were passed by Committees of Parliament last week.

EDENBRIDGE AND DISTRICT GAS BILL.

Adjustment of Clauses.

HOUSE OF LORDS.—Tuesday, May 12.

The Marquis of Winchester, the Chairman of the Committee who have been considering this Bill, sat this morning for the purpose of inserting a clause in the Bill to carry out the decision of the Committee [see "JOURNAL," May 12, pp. 442-3].

Mr. E. C. COOPER (Messrs. R. W. Cooper and Sons, Parliamentary Agents), on behalf of the promoters, said that he had submitted a clause to the petitioners' Agents; but they had objected to it, on the ground that it did not correctly carry out the Committee's decision, and put in another clause which they thought was more reasonable. He (Mr. Cooper) had assumed that the decision of the Committee was that if anybody else than the Edenbridge Company wished to supply in the added area they should have power to do so at the expiration of three years, and to repeal the Company's powers; but his power did not necessarily lapse if nobody else came forward to promote an Act of Parliament or a Provisional Order to enable them to supply the district. He did not think the Committee wished to deprive the inhabitants of the opportunity of supplying for all time; and his clause had been built up on this ground.

Mr. R. H. FOX (Messrs. Torr, Durnford, and Co., Parliamentary Agents), on behalf of the petitioners, maintained that this was not the intention of the Committee, and brought up for the consideration of the Chairman a proviso to clause 22, which he argued carried out the Committee's decision correctly.

The CHAIRMAN agreed, and allowed the petitioners' proviso to be inserted in the Bill.

The proviso reads as follows:—

> Provided, further, that if at the expiration of three years from the passing of this Act the Company have not laid down a 6-inch main along each of the routes A to B and E to F respectively, and a 4-inch main along each of the routes C to D, G to H, and I to J respectively, shown on the signed plan referred to in the section of this Act whereof the marginal note is "Limits for Supply of Gas," then the amount of additional capital which the Company may raise shall be reduced by £660 for each mile of 6-inch main and £440 for each mile of 4-inch main, and so in proportion for any less length of the before-mentioned mains which the Company shall not have laid.

CHELMSFORD GAS BILL.

This Bill was ordered to be reported for third reading by the Unopposed Bills Committee of the Lords last Tuesday. Under the Bill the Chelmsford Gas Company is to be re-incorporated as a parliamentary undertaking, with capital amounting to £123,850, consisting of £69,850 existing capital, and £54,000 additional capital, with borrowing powers of £23,280 upon the existing capital and one-third of the additional. The stock bears dividend at the rate of 5 per cent. per annum; the sliding-scale is applied, with the standard price of 3s. 9d.; and 14-candle power gas is specified in the Bill.

A new clause has been added, providing that if the Chelmsford Corporation promote a Bill next session to purchase the undertaking, the Company shall not oppose except on details; but the right is reserved to the Company to oppose the Bill to this limited extent. In the event of the Corporation obtaining an Act to purchase, they must give notice of their intention to purchase within six months after the passing of the Act; the purchase price being agreed upon, or determined by arbitration under the Lands Clauses Act in the event of disagreement. In addition, the Corporation are to pay any costs incurred by the Company in regard to their opposition (if any) to the promotion of the Act dealing with purchase, and also the sum of £200 in respect of the transfer of the undertaking and the winding-up of the Company. The Corporation are also, in the event of purchase, to pay compensation to the Directors of the Company, and to any officers and servants (except weekly servants of less than ten years' service) in the regular employ of the Company who shall not be retained by the Corporation. The Engineer, Manager, and Secretary, and any officer or servant of the Company who has been in the employment of the Company for ten years or upwards, is not to lose his right to compensation by refusal to accept employment under the Corporation, nor is any such refusal to be taken into account as a ground for reducing the amount of compensation to be paid.

WHITWELL AND DISTRICT GAS BILL.

The Unopposed Bills Committee of the House of Commons had the above Bill before them last Thursday; and it was sent forward for third reading, subject to the inclusion in it of the clause to be agreed by the two Houses of Parliament with regard to the calorific test.

Mr. WILLES JOHNSTON (Messrs. Torr, Durnford, and Co., Parliamentary Agents) said the Bill incorporated the Whitwell and District Gas Company, Limited, which was formed in 1912, and had only had one full year's working. The capital of the Company was £7700, and they were asking for an authorized capital of £22,700—£15,000 being additional capital—and one-third borrowing powers on the total authorized capital. The area of supply was in the South Yorkshire coalfield—a rapidly developing district. It was proposed under the Bill to add considerably to the supply limits. The Company asked for a standard price under the sliding-scale of 4s., which is the actual selling price. The dividend paid last year was 3 per cent.

Mr. *F. Richmond*, the Manager of the Company, explained the district which it is proposed to supply under the Bill. The capital was expected to last for ten or twelve years, provided the development of the district proceeded as was anticipated.

The CHAIRMAN asked why such a high standard price was asked for, when the district was actually on a coalfield.

Witness said that the coal produced in the district was steam coal. With regard to the calorific test, gas was used in the district almost entirely by incandescent burners, and not flat-flame burners.

The Bill has already passed the House of Lords [*see* "JOURNAL" for March 24, p. 845], when the question of the appointment of auditors was raised by the London Association of Accountants, and discussed at considerable length. The decision of the House of Lords Committee was that the name of the London Association should not appear in the Bill, and that the clause should give the option to a member of either the Institute of Chartered Accountants or the Society of Incorporated Accountants and Auditors. During the passage of the Bill between the two Houses, however, the promoters have agreed to the insertion of the words "or accountants approved by the Board of Trade;" and the clause in this form was allowed.

STONE GAS AND ELECTRICITY BILL.

This Bill, promoted by the Stone Gaslight and Coke Company, was last Thursday sent forward for third reading by the Unopposed Bills Committee of the House of Commons. It has already passed the House of Lords [*see* "JOURNAL," March 31, p. 921].

Mr. LEES (Messrs. Lees and Co., Parliamentary Agents) said that the Bill extended the limits of supply of gas by the Stone Gaslight and Coke Company, Limited, to include the remainder of the parish of Stone Rural not included under the Company's Order of 1881, and to enable the Company to supply electricity in the same limits in which they were authorized to supply gas. It also proposed to substitute a standard price for the maximum price fixed in 1881, and raise sufficient capital for the electricity undertaking.

Mr. *T. W. Saville*, the Manager of the Company, said the consumption of gas was steadily increasing. The present charge was 3s. 7d. per 1000 cubic feet. The undertaking had been carried on to the satisfaction of the local authority, who had presented a petition against the Bill in the House of Lords, but had withdrawn it on the Company agreeing to insert a clause which would enable them to promote a purchase Bill in 1916. The Company asked for £6500 additional share capital, with one-third borrowing powers, representing £2166, and the difference between one-quarter borrowing powers on the original capital, which was the practice when the Company was last in Parliament, and the more modern one-third, which represented £1458; making a total of £10,124. This was considered enough to establish an electricity undertaking, for which there was a demand in the district. The standard price asked for was 3s. 9d.; being 2d. per 1000 cubic feet above what was now charged. The Urban Council were satisfied that this was reasonable.

MEXBOROUGH URBAN DISTRICT COUNCIL BILL.

This Bill was last Thursday sent forward for third reading by the Unopposed Bills Committee of the House of Commons.

Mr. C. E. BAKER (Messrs. Baker and Co., Parliamentary Agents) said there were two Bills relating to Mexborough in the House of Lords—one promoted by the Mexborough Water Company for its incorporation, and the other by the Mexborough Urban District Council, for the purpose of acquiring the Company's undertaking. An agreement had, however, been come to that the Water Company's Bill should be withdrawn at the Council's request. With regard to the prices to be charged for the supply of water, there was a clause providing that at the end of five years the basis of charge should be altered from the gross value to the rateable value, thereby reducing the price.

The Bill was dealt with when it was before the House of Lords [*see* "JOURNAL," April 7, p. 50].

Coalite Developments.—The "Financial News" last Friday said: It is inferred from the circular issued this week by the British Coalite Company that developments of a very interesting character are going on. It is reported on good authority from the Midlands that contracts for the erection of large plants in the colliery districts have already been made, and that the Company is actively negotiating other important contracts, which should keep it busy for a long time to come; so that the further circular which is promised within the next fortnight should prove interesting reading to those who are interested in the coalite process.

Lurgan Gas Company's Bill.—The Lurgan Rural Council last week considered a report by the Irish Local Government Board regarding the Lurgan Gaslight and Chemical Company's Bill, which has been passed by the House of Commons Examiner to proceed. The Board pointed out that, if it is intended that the Company shall supply gas for lighting purposes in certain rural districts, the concurrence of the local authorities must be provided for. Such power might be given to the Rural Councils under the Public Health Act, 1878, by an Order of the Local Government Board under the Act of 1896. The Board wished to emphasize the local Councils' responsibility in the matter; as, if the Gas Company got the power applied for in their Bill, these Councils would be in future debarred from exercising their existing rights. The Council now decided to approve of recommendations safeguarding these interests, and to disapprove of any statutory powers being given to the Gas Company as asked for in the Bill. The Moira Rural Council have also passed a resolution approving of recommendations safeguarding their interests, and have entered a protest against statutory powers being given to the Company, which, as they believe would prove prejudicial to those interests.

LEGAL INTELLIGENCE.

ELECTRICITY CHARGES AT LONG EATON.

Judgment in Favour of the Gas Company.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, May 12.

(*Before Mr. Justice* SARGANT.)

Attorney-General, at the Relation of the Long Eaton Gas Company v. Long Eaton Urban District Council.

Judgment in this action, which was heard at the beginning of April, and the proceedings in connection with which were reported in the issues of the "JOURNAL" for April 7 and 14 (pp. 51 and 130), was delivered to-day.

JUDGMENT.

Mr. Justice SARGANT: In this action the Attorney-General at the relation of the Long Eaton Gas Company is seeking to restrain an alleged breach by the Long Eaton Urban District Council of the provisions of sections 19 and 20 of the Electric Lighting Act, 1882.

The defendants, the Long Eaton Urban District Council, whom I will hereinafter refer to as the "Council," are the undertakers under the Long Eaton Electric Lighting Order, 1900, and in that capacity have the powers and are subject to the obligations within their area which are given and imposed by that Order and the Electric Lighting Acts, 1882 and 1888. This area is in whole, or part, within the area within which the relators are empowered to supply gas under the Long Eaton Gas Act, 1901; and the alleged breach by the Council of their statutory obligations is undoubtedly one which might, and probably would, result in damage to the relators. With this aspect of the matter, however, I am not concerned, though no doubt it furnishes the motive for the institution of these proceedings. The Attorney-General is the plaintiff, and he is undoubtedly entitled to complain of any breach of statutory obligations of this kind without any proof of actual or apprehended damage. [Attorney-General *v.* London and North Western Railway, 1900, 1 Queen's Bench, p. 78.]

The area of supply of the Council is situate in a manufacturing district, the staple industry in which is the production of machine-made or Nottingham lace; and the electric energy supplied by the Council is used not only for public and private lighting, but also for supplying the motive power to drive various machines employed in that industry. Indeed, it is for this latter purpose that the main part of the energy sold is employed. No precise figures in this respect were furnished to me, though no doubt they are readily obtainable. But it appears that in the year 1913, while the total number of Board of Trade units sold to private consumers by meter was 1,363,181, and the total number sold to these consumers and for public lighting was 1,499,345, there were sold for power alone to the fifteen consumers of energy in the district, who took over 6000 units per quarter each, an aggregate of 966,036 units, which is over 70 per cent. of the former figure, and between 64 and 65 per cent. of the latter figure. It would probably be within the mark to say that at least three-fourths of the total number of units supplied are supplied for power.

The electrical undertaking of the Council is a comparatively small one. On the basis of the statutory accounts for the year 1913, the total rate of demand of electric energy that could be made at any one time by means of the simultaneous use of all the connections made is equivalent to that required for 59,152 8-candle power lamps, or, at 30 watts per lamp, to 1774 kilowatts. The total capacity of the station is 950 kilowatts. The maximum rate of demand actually made at any one time during the year 1913 was 658 kilowatts; and of this maximum rate of demand about 308 kilowatts appear to have been made for power, leaving about 350 kilowatts as the maximum rate of demand for light. If this maximum rate of demand had been made continuously and without variation throughout every moment of the year, the actual number of units supplied or consumed during the year would, of course, have been the product of 658 multiplied by 24 multiplied by 365, or 5,764,080 units, instead of the actual supply of 1,499,345 units. And the ratio of the latter figure to the former, expressed as a percentage, which is what is called in electrical engineering the load factor, is accordingly some 26·01, which is admittedly an exceptionally favourable figure. This excellent load factor is no doubt due not only to the large proportion of the electric supply which is taken for power—the demand for which is usually longer, and is more even throughout the year than that for light—but to the exceptionally long hours for which the mills in the Long Eaton district are worked. It appears from the evidence that the normal hours for which the main part of the machinery—viz., that which is used by the male operators—is worked are from 4 a.m. to 12 midnight, and that, though in slack times mills may work only 12 hours per diem, or even be closed altogether, on the other hand in busy times there is a continuous working of the mills throughout the whole 24 hours. As regards some part of the machinery—viz., the winding machinery, which is run by female labour—the Factory Acts prevent night work. But even in the case of this machinery, which I estimate on the evidence as not using more than 20 or at the most 25 per cent. of the total power load, the normal working is for 12 hours a day—viz., from 6.30 or 7 a.m. to 6.30 or 7 p.m.

It will also be noticed that though at least three-fourths of the units supplied were supplied for power, the installation at the defendants' power-station necessary for the supply of these units was actually less than that required for the supply of the units for light, since, as I have said, the maximum demand at any one time in the year 1913 was at the rate of 308 kilowatts for power, and at the larger rate of 350 kilowatts for light. It should be added that throughout the Council's area gas is in active competition with electric energy, both for supplying light and for supplying motive power. Some works use electric energy for both purposes, and others use gas for both purposes. Some use electricity for power and gas for lighting, and others use gas for power and electricity for lighting. Steam is but little used, especially in the more modern shed factories, which appear to be superseding those built with more than one storey.

The undertaking of the Council has been a successful one, and it has been possible not only to earn profits, but to lower the rates charged for the supply of electric energy. There was a reduction in these rates as from March 31, 1905, and again as from April 1, 1910. Since the last date, and subject (only as from June 1, 1912) to the change complained of in this action, the rates charged have been those shown in a printed scale put in evidence. Under this scale the most important rates of charge are for the purposes of this action: (1) For lighting houses, shops, and other premises, except factories, a flat-rate of 3½d. per unit less 10 per cent. discount. (2) For lighting factories, 3d. per unit for the first 2000 units per quarter, afterwards 2d. per unit, less in each case certain discounts increasing with the amount of the account. And (3) for power or heating, for a consumption not exceeding 250 units per quarter, 2d. per unit, and for larger consumptions per quarter a gradually decreasing charge per unit, until for a consumption between 4000 and 6000 units per quarter the rate is 1d. per unit, and for a consumption exceeding 6000 units per quarter the rate is ¾d. per unit. I need hardly add, and what is a matter of some importance here, that the difference in the rates of charge for lighting and power respectively involves this—viz., that if a consumer desires a supply for power as well as a supply for light, he must have a separate circuit on his premises for the supply for each purpose, each circuit being separately connected with the mains, and having a separate meter at its terminals. Each such circuit is as separate, electrically speaking, from the other as if it furnished a separate supply to a different consumer; and the consumer who has the two circuits can use the maximum supply of electricity through each circuit simultaneously.

Down to this point no criticism is suggested of the Council's charges. What has given rise to the present proceedings is a circular which was issued by the Council on or about Sept. 25, 1911, and which is couched in the following terms:

> "Dear Sir,—I am directed by my Council to inform you that the following resolution has been adopted with reference to the price charged for electricity to power consumers, and which will take effect as stated therein: 'Revision of Electricity Charges. Committee having fully considered this matter recommend that the present scale of charges remain in force where power and lighting are both taken exclusively from the Council's electricity mains, but in cases where electricity supply is taken for power only, or for power and partial lighting, the lowest scale of charges, where the number of units consumed during any quarter exceeds 4000, shall be 1d. per unit, and otherwise according to existing scale.' Such amended charge to commence Jan. 1, 1912."

It is alleged that the differentiation expressed in this circular between those large consumers of power who take power and lighting exclusively from the Council's mains and those large consumers of power who take for power only, or for power and only partial lighting, is a breach of sections 19 and 20 of the Electric Lighting Act, 1882; and it is sought to restrain this differentiation by injunction of this Court.

The matter has in fact been argued before me entirely on the differentiation between a consumer A who takes power exclusively and light exclusively from the defendants and a consumer B who takes power exclusively from the defendants, and takes either no light or only some of his light from the defendants. No comparison has been made between A and a consumer C who takes power to the 6000 units per quarter limit and the whole of his lighting from the defendants, but also takes some power from another source. It may be that, whatever the intention of this circular, C, though not coming within the definition of a person taking power and lighting exclusively from the Council, is nevertheless not within the subsequent definition of those persons whose rates of charge are increased by the circular, and, accordingly, is left untouched by it. I merely mention this to prevent its being supposed that the point has been overlooked, and for the purpose of remarking that if C were proposed to be brought within the scope of the circular, his case against differentiation would appear to be clearer than the case of B. However, the proposed differentiation between consumers of the same class as A, on the one hand, and consumers of the same class as B, on the other hand, is no doubt the practical one; and it is to this differentiation that I propose to confine myself.

Sections 19 and 20 of the Electric Lighting Act are in the following terms:

> (19) Where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the License, Order, or Special Act authorizing such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply.
>
> (20) The undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company, or person, but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or in pursuance of the License, Order, or Special Act, authorizing them to supply electricity.

It is said by the plaintiff that both sections of the Act are infringed—section 19 because the supply of electricity to B for power purposes is a supply corresponding with the supply to A for power purposes, and is applied for and given under similar circumstances; section 20 because the lower charge to A is an undue preference. It is said by the defendants as regards section 19, first that the supply to A for power and exclusive light is not a supply corresponding with a supply to B for power only or for power and partial lighting; and, secondly, that even if the supply to A for power has to be considered separately, and so "corresponds" with that to B, still the circumstances are not similar in the two cases. As regards section 20, defendants say that there is sufficient dissimilarity in the conditions of supply between

the two cases to prevent the difference of charge, though perhaps preferential, from amounting to an undue preference.

The first defence as regards section 19 seems to me a question of construction; and I will deal with that defence first. As already pointed out, any supply of electricity for power is in the ordinary course taken quite separately from any supply for lighting—viz., by a separate circuit connected with the mains by separate terminals, and with a separate meter. This being so, I think that, according to any ordinary use of words, the Council must be said to be offering not a single supply of electricity, but an alternative supply, and that any consumer taking for power and light in the ordinary way on separate circuits would be said to be taking not a single supply but two supplies—viz., a supply for power and a supply for light. I can see no sufficient reason for cutting down the beneficial operation of section 19 so as to prevent its application to each such separate supply. In my judgment, the hypothetical consumer B, though taking a supply for power only, is taking a supply corresponding with the like supply of energy to A for power purposes, although A may also be taking an additional separate supply for light. If any differentiation is allowed between them *quâ* their respective supplies for power, it must be on the ground that the circumstances are not similar in the two cases.

The second defence as regards section 19 and the defence as regards section 20 seem to me to be very much the same, and to differ, if at all, only in degree. Under each section I think that the whole circumstances may be considered from the broadest possible point of view, and that the question is whether the circumstances affecting consumer A or consumer B in relation to their supply of power are substantially dissimilar or sufficiently dissimilar to broadly justify the differentiation proposed by the circular. The general language of the two sections and their relation to each other are curiously similar to those of section 90 of the Railways Clauses Act, 1845, and section 2 of the Railway and Canal Traffic Act, 1865; and some of the decisions under these Acts, as well as the one or two decisions under the Act now in question, or equivalent legislation in the Colony of Melbourne, are in point here.

The most important and apposite of the railway cases that have been cited to me are the London and North-Western Railway *v.* Evershed (3 Appeal Cases, p. 1029); Denaby Main Collieries Company *v.* Manchester, Sheffield, and Lincolnshire Railway (11 Appeal Cases, p. 97); Baxendale *v.* Great Western Railway (28 Law Journal, Common Pleas, p. 69); and Phipps *v.* London and North Western Railway, 1892 (2 King's Bench, p. 229). From these cases and those of the Metropolitan Electric Supply Company *v.* Binder, 1902 (1 Chancery, p. 411), and Attorney-General of Victoria *v.* Corporation of Melbourne, 1907 (Appeal Cases, p. 469), I think a fairly clear distinction may be drawn for the present purpose between those reasons for making a lower or preferential charge which under legislation of this kind are legitimate and those which are illegitimate. It would seem that A must not be charged less than B merely to overcome a greater reluctance on the part of A to become a customer, or to induce A to become a customer in respect of another supply, although either of these reasons might be a good commercial reason for charging less to A were the public undertakers merely carrying on any ordinary commercial business. On the other hand, any circumstances which render it less costly, or otherwise more profitable, to supply A than B, constitute a legitimate reason for making a lower charge to A for the same supply. If the Court once came to the conclusion that some such circumstances existed, then proof would not be required that the diminution in the charge was precisely equivalent to the diminution in the cost of the supply. To apply these principles to the present case. If, as alleged by the relators, the object and result of the circular were to coax or induce those who took power only, or power and partial lighting, to take the whole of their lighting from the Council, and the extra custom thus obtained would not *per se* make the rendering of the existing service less costly or more profitable to the Council, then the policy of the circular would be wrong, and the differentiation between A and B would be illegal. But if, on the other hand, the combination of lighting, or exclusive lighting, would make the supply of power, or of power and partial lighting, to the customer in question less costly or more profitable, then there would be a justification for reducing the charge to A as compared with B, or (to follow the precise lines of the circular) for increasing the charge to B as compared with the charge to A.

As I understand the argument, this view of the law was accepted on both sides, and the contest between the parties really resolved itself into one of fact—viz., whether as between customer A who takes power exclusively and light exclusively from the Council and customer B who takes power exclusively from the Council, but either no light or only part of his light, the taking by A of an exclusive supply of light renders it cheaper or more profitable to the Council to give a supply of power to him than to B. The onus of establishing this would appear to rest on the Council. Speaking generally, the technical and other evidence by which they sought to prove their case seemed to me extremely thin. On the other hand, no technical evidence at all was called by the plaintiff. In this state of things I must do the best I can on the materials before me. But should the same sort of question ever be fought out again with reference to a larger undertaking, there would be room for much fuller and more complete technical evidence on both sides.

One thing seems fairly clear from the evidence of Mr. William Johnson—viz., that before making the change the Council did not seek technical advice, and that in making it they were not acting on any reasoned or effective comparison of the cost of supplying the typical consumer A with power as compared with the cost of supplying the typical consumer B with power. Nor would it, I think, be doing the Council an injustice to say that the change was made merely on a rough general view of commercial inducement to the consumer and commercial advantage to the Council, in which no distinction was made between, on the one hand, coaxing or inducing customers to increase their custom by taking a second supply, and, on the other hand, lowering a charge to a customer for an existing supply in return for his lowering the cost of that supply by taking a supply of a different kind. They obviously had little, if any, idea as to what was, or was not, prohibited in this respect by their statutory obligations. Mr. Snell, the Council's expert, of course, was better informed. But even he (as will be seen) fell into some mistake on this point; and he was apparently only called in long after the change, and for the purpose of giving evidence in this action, and justifying the change *ex post facto*. If, therefore, the Council have a good and sustainable reason for giving lower terms for power to customer A than to customer B, this would seem to be due rather to good fortune than to good judgment.

The only evidence in justification of the preference to customer A that has to be seriously considered is that of Mr. Snell; and a good deal of his evidence may be dealt with very briefly. At the end of his examination in chief, he relied on the extra business thus secured in supplying energy for lighting. But this is an inadmissible reason. In another part of his evidence he pointed to the progressive improvement in the load factor of the undertaking down to the present time. But this had been taking place quite as much prior to the change as subsequently to it. He also referred to the figures in relation to the supply of various particular consumers (as to which I will say a few words a little later), but which when examined certainly do not seem to help his case. All this seems to me of little if any value. The only part of Mr. Snell's evidence which struck me as really relevant or important was that in which he attempted to show that, under the special conditions of Long Eaton, the supply of energy for lighting factories is in a sense supplementary to the supply of energy for power, and improves the load factor of the undertaking by providing a demand for the machinery at the defendants' power station at a time when it would otherwise be idle. Mr. Snell, of course, had to acknowledge that as the load factor for light is much worse than that for power, a customer for both power and light has in general a worse load factor than a customer for power only. For inasmuch as he takes his maximum load for light from time to time concurrently with his maximum load for power, his total load factor is a mean between the worse load factor for light and the better load factor for power, though the lower load factor for light may be, and should be, if the relative prices for light and power are fair, compensated for by the higher price per unit charged for light. But he said that inasmuch as at Long Eaton some 20 per cent. of the power load—viz., that attributable to the winding machinery—is not working before 7 a.m. or after 7 p.m. the factory owner who takes light as well as power gives during the summer (by which I mean the lighter) months of the year an opportunity to that portion of the machinery at the central station which may be regarded as installed against the winding machine load of being used for the production of light during the whole or some of the hours between 7 p.m. and midnight, and the whole or some of the hours between 4 a.m. and daylight, or in times of great activity, between midnight and daylight. The result, said Mr. Snell, was that the load factor of such a consumer—consumer A—was improved, and that he was in truth a better customer—a customer who could be supplied more cheaply—than customer B.

This would no doubt be quite true if no more machinery had to be installed to supply customer A than customer B, or if, what is much the same thing, the load factor could properly be calculated with reference to the maximum demand or load during the summer months of the year, and not with reference to the maximum load throughout the whole of the year. But in fact the contrary is the case. The demand for electric lighting is, of course, a demand that varies seasonally; and the demand or load that really matters, and against which power has to be installed, is that during the winter or dark months, as indeed is indicated in the calculation of load factor in the Council's accounts on the usual annual basis. Further, there is nothing whatever to prevent the period of the maximum or peak load for lighting being coincident with the maximum or peak load for power; and, indeed, so far as the factories alone are concerned, there is a good deal to make the two synchronize. Accordingly, it is quite clear that the typical consumer A when compared with the typical consumer B must be considered as necessitating the installation in the central station—not merely of machinery sufficient to satisfy his demand for power, but also of extra machinery to satisfy his demand for light—and so as increasing to that extent the denominator of the fraction representing his load factor before its conversion into a percentage. If this be so, it is difficult to see on what principle the machinery used to supply power to the winding machinery run by female labour can be considered as being profitably employed in supplying light to those parts of the factory which are run by male labour. For, *ex hypothesi*, other machinery has had already to be installed for the purpose of supplying light, not merely to the principal part of the factory where the male labour goes on working, but also to that portion of the factory where female labour is employed, and where the supply of light is not required for any longer hours than the supply of power. When this difficulty was put to Mr. Snell, the only answer that he could give to it was that during the summer months the plant was overhauled, and that one by one the units at the central station were dismantled. But I cannot think that this explanation was at all adequate or satisfactory, having regard to the capacity of the station—viz., 950 kilowatts—and having regard also to the marked difference (as shown by the summer and winter curves put in) of a maximum daily winter load of some 658 kilowatts, and a maximum daily summer load of some 308 kilowatts. This seasonal difference alone must obviously give ample opportunity for overhaul, and for dismantling more than one unit at a time, unless the units are of a size altogether disproportionate to the output of the station, and indeed are only two in number. In the absence of anything like definite information on this point, either from Mr. Snell or from the Engineer of the Council, I cannot look on this supposed advantage with regard to overhaul as any real justification of the differentiation between consumer A and consumer B.

It seems to me that, large user being already allowed for in the condition that 6000 units are to be consumed per quarter, and there being no constat that consumer A does in fact consume more altogether than consumer B, whose bill for power alone may largely exceed that for the power and light consumed by A, no real reason has been shown for regarding A as a more profitable customer than B. A's load factor, calculating it in the ordinary and proper way over the year, and not over a portion of it, is worse than B's, and worse substantially in proportion to the amount of light he takes, as indeed it should be, having regard to the fact that he pays more per unit for light. And the taking of two supplies by A does not involve any diversity factor in A's

demand if I rightly apprehend the sense in which Mr. Snell used that term; for A's peak time for power and peak time for load may be and often are concurrent, the whole factory, of course, requiring to be lighted for instance at 6 p.m. during the winter months when the demand for power is in full force. Though I have defined B as a customer who either takes for power only or who takes for power and partial lighting, I have hitherto considered him in the light of the first alternative—viz., as taking for power only. But if he is now considered as taking for power and for partial lighting, any differentiation between him and A is even less, and the preference shown to A is even less defensible. He may well be taking more for power than A and more for light than A, and may be taking them in the same relative proportions as A. Yet if he takes any light at all from any other source, he is to be denied the allowance of 25 per cent. made to A. This is not in my judgment a mere isolated or exceptional case of hardship such as might be found under any scale increasing by definite steps, but an example of a class of cases likely to occur and specially aimed at by the circular. It seems to me impossible to justify such a differentiation as this; and the express making of the differentiation is a very strong indication that the reason for making it was not the relative cheapness of supplying A, but the desire to oust competition in supplying light.

The only other matter I need refer to is a table called Appendix A, which was put in by the Council for the purpose of showing the average price paid by the seventeen consumers who fall within the same class as the hypothetical consumer A. So far as it goes, the table seems to me to tell strongly against the Council. On the two scales adopted by the Council, each of no less than seven of these sixteen consumers pays less to the Council for power and lighting together than he would do if he took the same amount of power alone. And the whole number of these consumers, who together take very much more than half the total units supplied by the Council, only pay £34 5s. 2d. extra for the 81,069 units supplied to them for lighting purposes. Now not only are these units nearly one-tenth of the units taken for power, for which £2799 18s. 4d. is paid, but, having regard to the difference in load factor between light and power, they must require an installation of probably about one-third of the machinery which is needed for the power units taken by these consumers. And, as stated at the foot of the table that the Council reduce accordingly, if 1d. per unit is a proper sum for a supply of power, and 3d. per unit is a proper sum for a supply of light, it is obvious that the supply of light to these consumers causes the Council an extraordinary loss.

The foot-note to the table is in the following terms—viz., "Thus to acquire 9·16 per cent. more business the Council reduce the price 6½ per cent."—may throw some light on the object with which the reduction is proposed to be made as between A and B. But the comparison made by it is obviously wrong; for it assumes that but for the reduction, the 81,098 units of light, as well as the 884,938 units of power, would have been taken and would have been charged for at 1d. Further, the reduction is, of course, not 6½ per cent. at all, but 25 per cent.—viz., from 1d. to ¾d. The commercial effect is that 81,098 units of light, which ordinarily would, at 3d. per unit, cost £1013 14s., are in fact supplied for £34 5s. 2d.

In the result, I come to the conclusion that there is a breach both of section 19 and of section 20. Of section 19, because B is asking for a supply of power corresponding with that demanded by A and under similar circumstances. Of section 20, because an undue preference is by the circular to be given to A as compared with B.

The plaintiff is in my judgment entitled to a declaration that the differentiation proposed by the circular of Sept. 25, 1911, between those consumers of over 6000 units per quarter for power who do and those who do not take their lighting exclusively from the Council, is in contravention of sections 19 and 20 of the Electric Lighting Act, 1882. Then there will be liberty to apply for an injunction if necessary. If the defendants determine to appeal, no such application will be made while the appeal is pending.

The defendants must pay the costs of the action.

A PUMPING-STATION RATING APPEAL.

Chertsey Union v. Metropolitan Water Board.

On May 8 the Divisional Court, consisting of Justices AVORY, ROWLATT, and SHEARMAN, heard the case of the Assessment Committee of the Chertsey Union *v.* Metropolitan Water Board. The plaintiffs appealed from the judgment of the Court of Quarter Sessions dated April 11, 1913,* in respect of certain property known as the Walton Pumping-Station, reducing the gross value from £15,810 to £11,677, and the ratable value from £10,550 to £7785.

Mr. PAGE, K.C. (with him Mr. W. MACKENZIE), said the case came before the Court upon a special case stated by Quarter Sessions, and raised three questions, one of which was decided against the Union, and the other two in their favour. The first point was whether anything should be added to the value of the premises, which consisted of an intake from the River Thames, canal, and pumping-station, by reason of the fact that the intake was used for bringing water into the rest of the premises, which water was distributed among the inhabitants of London. The second point related to property upon which the Assessment Committee put a rate, and (which was the subject of the appeal) consisted, in the first place, of land, and, next, buildings upon the land. It was argued for the Board that, inasmuch as they were able to borrow money at a cheap rate, the ordinary percentages should not apply either to the land or machinery and buildings. The figures put by the Union were 4 per cent. on land and 5 per cent. on buildings; and as the Board borrowed at 4 per cent., it was said they ought not to pay more than 4 per cent. on the whole. This point was decided in favour of the Union. The other point was whether there were certain embellishments on the property.

Mr. HUGH MOULTON (who, with Mr. BALFOUR BROWNE, K.C., appeared for respondents) said this point was not now raised.

* See "JOURNAL," Vol. CXXII., p. 189.

Mr. PAGE said, as to the first point whether anything should be added by reason of the user of the intake, the Court decided against the Union, as they thought the case of *New River Company v. Hertford Union* was distinguishable from the present case. But his submission was that in both cases the facts were the same. The special case stated that the Board were owners and occupiers of a large hereditament in the parish of Walton-on-Thames, that one of the undertakings transferred to them was that of the Southwark and Vauxhall Company, who had statutory power to take water from the Thames; and in 1898 powers were given to them to maintain a pumping-station at Walton and to erect an aqueduct and lay a line of pipes. In 1899, the Company acquired the land on which were situate the pumping-station and line of pipes. They did not, however, erect the buildings, and so the power lapsed. But the Board, having acquired the undertaking of the Company, got the power revived. The land, consisting of 9¼ acres, was separated from the Thames by a towing path 23 feet wide; and the water passed under the path and flowed into underground tanks from which it was pumped. The Board, having acquired other undertakings, had a right to take water from twelve intakes. By a supplemental valuation list made in June, the hereditament described as intake, &c., was assessed at £18,000 gross, £12,000 ratable. The Board objected to the assessment, and ultimately the amount was agreed at £15,750 gross and £10,500 ratable; and on this sum the rate was paid. In 1912, a dwelling-house was erected on the land, and the assessment was then increased. In July, 1912, the Board gave notice of objection and appealed, on the ground that they were over-rated; and Quarter Sessions, after hearing the case, reduced the assessment, subject to the opinion of the High Court as to whether they had come to a correct decision in law. The Court decided that the undertaking should be dealt with under the ordinary rates of 5 per cent. for buildings and 4 per cent. for land, and that no undue expenditure had been incurred in respect of embellishments—the amount attributed to this head being negligible when the total cost of the undertaking was considered. They also found that the facts of the case were clearly distinguishable from those in the Hertford case. The Court did not find there was anything to be added to the assessment in respect of adaptability of the property. Appellants' contention was that, in addition to the amount allowed, based on the value of the land and the structural value—viz., £7785—the Court was bound to add something for the added value by reason of the user made by the intake.

The Judgment.

On the resumption of the hearing on May 12,

Mr. Justice AVORY, in giving judgment, said he was of opinion that, on the first question, of the extra sum being added by reason of the user of the "intake" and the adaptability of the land for its purpose, the Chertsey Union appellants succeeded, as the point was covered in the case of *New River Company v. Hertford Union*. The Court was bound to take into consideration the added value of the land by reason of its fitness for the purpose, and the Magistrates were clearly wrong in saying that the facts of the case were distinguishable from those of the Hertford Union. The principles laid down in the Hertford Union case applied to both. His lordship said he thought it was clear the Magistrates did not apply the correct principle, and had not taken this added value into account in arriving at the figures. Therefore, on this point the case must go back to Quarter Sessions for the principle of added value to be applied, and the figures adjusted accordingly. With regard to the point on which the Water Board appealed regarding percentage, he thought this was not a question of law at all; and unless Counsel for the Board could satisfy the Court, as a matter of law, that when a public body was in a position to borrow money on a certain percentage it followed they would never give rent for any hereditament representing a greater sum than the percentage of the capital cost at which they would purchase the property. It was impossible for the Court to direct Quarter Sessions that they were bound to fix a ratable value at a figure represented by the percentage at which they could as a public body borrow money. On this point the Quarter Sessions were correct. The result would be that the case must go back on the first point only for the Magistrates to determine the added value in accordance with the case of the Hertford Union.

The other Judges concurred, and the appeal was allowed, with costs—the case to go to Quarter Sessions on the point in question, and the costs of the former hearing and the subsequent hearing to abide the decision of Quarter Sessions.

Action Resulting from a Leak.

At the Whitechapel County Court, on Friday, Judge Cluer had before him a claim for damages by Mrs. Emily Martin, of Senrab Street, Stepney, against the Commercial Gas Company, to recover £20 damages. It was alleged that, in consequence of a leakage from the Company's mains, gas entered the plaintiff's house, and caused her to become ill, rendering her unfit for work for about ten weeks. When the case was called, Mr. Green (for the plaintiff) said a settlement had been arrived at. The Company had agreed to pay the plaintiff a sum of money and the taxed costs. Judge Cluer said he was told that the Registrar could not tax the costs without a judgment being formally entered. Mr. Cassels (for the Company) said that judgment could be entered for the sum of twelve guineas and costs; and this was done.

Natural Gas For Train Lighting.—During last year, according to statistics issued by the Medicine Hat (Alberta, Canada) Board of Trade, natural gas was supplied to 23,874 coaches and cars of passenger trains, making an average of 2000 cars per month, or 60 cars per day. The tanks are filled from the Canadian Pacific Railway Company's big gas well, which is one of twenty situated within the city. As the pressure at the well is in excess of 550 lbs. per square inch, no pumping is necessary. The tanks on the passenger coaches have an average burning capacity of forty hours per car, with an average burning period of seven hours out of each twenty-four. Natural gas is also burned on the Canadian Pacific on through passenger trains from Vancouver to Montreal.

MISCELLANEOUS NEWS.

GUARDIANS AND A LIGHTING LOAN.

An Inquiry at Islington.

For three days last week, beginning on Wednesday—the average time of sitting being about seven hours a day—Mr. T. C. EKIN, an Engineering Inspector of the Local Government Board, was occupied at the offices of the Islington Guardians in St. John's Road, Upper Holloway, in a public inquiry regarding an application by the Guardians for sanction to a loan of £3600 for the purpose of installing electricity in various institutions under their charge.

The Guardians were represented by Mr. J. H. PRICE (Solicitor). Mr. A. M. BRAMALL (their Solicitor) appeared for the Islington Borough Council; and Mr. H. A. COLEFAX, K.C. (instructed by Messrs. Monier-Williams, Robinson, and Milroy) for the Gas Light and Coke Company, who were attending as large ratepayers and the present suppliers of light to the premises concerned. Mr. A. E. PETTET (a guardian) opposed as a ratepayer, as also did Mr. PEALLING.

Alterations in the scheme after its inception complicated the mass of figures produced, and the calculations based thereon. Originally the proposal was to instal electricity for lighting and motive power in the Guardians' offices and workhouse in St. John's Road, the workhouse in Cornwallis Road, and the Guardians' school in Hornsey Road; but subsequently some receiving homes, &c., were added. The present lighting is by gas; while the power required is derived from steam-boilers. Towards the end of last year, Mr. Ekin investigated the proposal on the spot; and subsequently the Local Government Board insisted upon the application for the loan forming the subject of a public inquiry. As soon as the Gas Light and Coke Company heard of the suggestion to instal electricity, they wrote asking to be given an opportunity of submitting proposals for modernizing the existing gas installation. This they did; submitting a scheme involving a capital outlay to be repaid free of interest in fifteen years, and including a stated sum per annum for maintenance. This scheme they claimed would result in a big monetary saving, accompanied by a very material improvement in the lighting. The Company offered to fit up a portion of one of the institutions to demonstrate the nature of their proposals.

First Day.

Mr. PRICE, in opening in support of the application for the loan, said that towards the end of 1911, in consequence of the fact that electricity was getting cheaper than it had previously been, a report was prepared on the subject of installing electricity; and the Gas Company wrote a letter objecting to the scheme. The report was then referred back by the Board to the Special Committee, who again went into the question. After further consideration, this Committee made a second report to the Board in December, 1912; and instead of, as at first proposed, 200,000 units having to be paid for for power purposes in five years (with a charge of 2d. per unit for light and power), the amount was reduced to 125,000 units. After the first year, the Guardians would have to take a supply of electricity of the minimum value of £1000 a year. This came before the Board in January, 1913; and, with the alteration that the £1000 a year stipulation was struck out, the report of the Special Committee was adopted. This appeared to end the matter, subject to the sanction of the Local Government Board being obtained. But the Board of Guardians was an expiring one; and it was felt that this expense should not be undertaken at such a stage. So the resolution to apply for sanction was not acted upon. When, however, the new Board came into office, they passed another resolution that the Committee be re-appointed, with an instruction to consider the whole question of lighting and to report again before application for permission to proceed with the scheme was made to the Local Government Board. So there was once again a fresh inquiry by the new Committee, though no doubt this new Committee consisted of a great majority of members of the old Committee. The new Committee assented to the striking out of the £1000 stipulation; and in October, 1913, they again reported to the Board in favour of electricity. They recommended that sanction be applied for in respect to the institutions in question, and that an agreement be entered into with the Borough Council for a supply of current at a charge of 2d. per unit, with a minimum of 125,000 units for power during five years. The charge was, as already mentioned, to be 2d. all round. Under section 20 of the Electric Lighting Act of 1882, the Borough Council could not give any undue preference to any local authority, company, or person; and they were advised that under this section they could not give the Board of Guardians any preference. Whatever they did for them, they must be prepared to do for any other consumer under the same conditions. The Board having adopted the third report of the Special Committee, they applied to the Local Government Board for their sanction. All parties, he thought, agreed that the present lighting was inadequate and inefficient; and the Guardians thought the electricity scheme would be more economical than the favourable terms of the Gas Company. The Local Government Board, after going into the matter, had asked for further information; and the present inquiry was being held so that a definite conclusion might be arrived at as to the carrying out of one or other of the schemes. The Gas Company proposed to effect a great saving by the adoption of inverted incandescent burners; but in many positions—draughty corridors, &c.—this system would not be suitable. The Company suggested a fixed charge for maintenance; but this was based on an attendance of once a week in winter and once a fortnight in summer. The officers considered, however, that a daily attendance would be necessary to look after certainly the greater part of these mantles. If, too, the Company could not place all the incandescent lights intended, this would very largely affect even their own estimate of saving, which was based on the installation of inverted lights. A point had been raised that by the abolition of gas, and the substitution of electricity, there would be a loss of heat which would have to be provided for; but it was denied that gas was used in any way for heating and that additional radiators would be called for. There was, of course, the question of cleanliness to be considered. As to finance, the Gas Company said they paid £16,000 a year for rates in Islington; but the borough electricity undertaking also paid rates, though to a smaller amount. The electricity undertaking had been handing over substantial profits to the rates, so that it was not being conducted at a loss.

The INSPECTOR: Are the Borough Council supplying other consumers at a 2d. flat-rate?

Mr. BRAMALL: No. We are quite willing to give the customary charge of 3d. per unit for lighting and 1d. for power. If sanction is given, I take it our position is we cannot offer any concession to the Guardians that we do not offer to other consumers.

Mr. *James Enright*, the Electrical Engineer who had drawn up the scheme for the Guardians, was the first witness called, and was under examination, and searching cross-examination, for several hours. He said he had made various reports, and went at length into the suggestions made therein. The total number of lights proposed to be put in the different buildings was 2437, from 2137 points, at a cost of £3372. His specifications did not include the cost of bringing the cables from the roadway up to the building. The consumption for lighting would be 69,792 units at 2d.—£581 12s.; and then there would be the maintenance and other charges. In his calculations, there was plenty of scope for increasing the size of the lamps without adding to the yearly expense. The basis of his original figures was four hours' burning per day, with a consumption of 20 watts. Assuming 20 candles illumination, this would give a total light of 48,740 candle power. Reckoning the yield at 16 candles, it would be 39,000 candles. He had also got out figures relating to light and power combined, giving a total of 84,632 units at 2d.—£705. Institutions like these, with many draughty corridors, and where carelessness might prevail, were, in his opinion, the most unsuitable places for incandescent gas mantles. The saving in coal (which he put at about £300 a year) and in respect to cleanliness had to be considered in favour of electricity. The total cost he put at £953 10s. a year.

Mr. PRICE remarked that, especially as the Guardians were not unanimous in the matter, he was anxious to put everything forward in the best way possible. Nothing whatever would be suppressed.

The INSPECTOR: As to lamp renewals, 1000 hours might be considered as the average life of a lamp; and the figure you give allows for replacing about one-half of the lamps each year.

Witness: I think that is the right thing to allow.

Cross-examined: Of the estimate of £3372, about £540 was attributable to power, which left £2832 for lighting. The figures were arrived at as the result of experience. He believed many firms would carry out the work at the prices named. There was nothing in his specification relating to his fees; nor was the cost of bringing the cables in to be found there. The Guardians had been advised against the use of electrical machinery for laundry purposes—but not by an electrical expert.

Mr. BRAMALL: How have the Gas Light and Coke Company got hold of confidential reports submitted to the Council?

Mr. COLEFAX replied that, so far as he knew, the Company had never seen the report. They had seen a statement dealing with the matter in an Islington paper, which stated that a promising scheme to introduce electricity in the laundries of the Guardians had been "knocked on the head by an expert."

Witness was then cross-examined at considerable length regarding the methods by which he had arrived at his totals; and he undertook to bring forward definite figures the following day. He said he had included £125 12s. for replacement of lamps; and there was very little other maintenance required. In his report dated 1912, he gave the average life of the lamps as 700 hours, and the cost at about 2s. each. The 700 hours referred only to the time the lamps would burn without seriously deteriorating. It was put to him that, if the lamps only lasted 700 hours, the maintenance would cost somewhere about four times as much as he had allowed; and that if the life was taken at 1000 hours, instead of his £125 12s., the sum would be something like £400 per annum. He denied, however, that this was the correct interpretation to put upon his figures. Reckoning the extra amount paid for power under the arrangement proposed (the charge to be 2d., instead of 1d.), the cost of current for lighting would be 2·2d. per unit. This would make some difference to his totals. Of course, if the cost for lighting was increased in this way, the charge for power would be reduced to 1d.

Mr. PETTET observed that the lights at Cornwallis Road had been gradually altered from flat flames to incandescent ones; and this had resulted in a great saving. He suggested that certain figures in Mr. Enright's report were more or less guesswork. The whole question before the Committee had been so absolutely muddled up that one had been fogged all the way through. An original figure was given; and extra points had since been added indiscriminately without any extra sum being put on the estimate.

The INSPECTOR (to witness): How did you arrive at the number of 2437 lamps? You will remember I was struck very much by an incident when I was here last. We went into one of the buildings, and I asked: "How do you propose to light this place?" You astonished me by replying: "I have hardly considered. That is what the Guardians will have to decide." How can you arrive at the total number of lamps, if that is so?

Witness: What I meant was that I did not know exactly where I was going to put each lamp.

Supposing you had arranged for the lighting by pendants and the Guardians decided they would have side lighting, would the same number of lamps do?—They might, and they might not; it depends upon the room.

This estimate is practically based upon figures you got out two years ago. Since then there has been a very marked increase in the cost of materials and labour?—That is so; but I believe it can be done as cheaply now.

Do you? I go about the country; and I find the increase varies from 10 to 20 per cent.?—The work you can now get done for a certain amount of money, you could not have got done a few years ago.

Mr. *Frank Sutor*, who had carried out an installation of electricity in

the Highgate Infirmary for the Board, said he would have no difficulty in getting a firm to do the work on the specification shown. Four hours was too long to take for the average consumption of each burner. To test the gas consumption, he had taken a Bray flat-flame burner, and found it burned 9 cubic feet per hour. Then he took an inverted burner, which came out at roughly 4 feet, and an upright one which consumed 6 feet. Taking the total gas consumption, and striking an average, he arrived at an average number of hours of just over two per day; and if this was sufficient for gas, 1½ hours would be enough for electricity. If 40-watt lamps were employed, they would never use the quantity of current Mr. Enright had put down. The figure taken for lamp renewals (one lamp in two years) erred on the right side. He did not consider that inverted incandescent burners could be installed all over the buildings; and the maintenance arrangement, he thought, was not practicable. If they had a man permanently on the work, it would not be sufficient.

Second Day.

Mr. *A. H. Dykes*, Consulting Electrical Engineer, said that in 1911 there were 2200 flat-flame burners; and assuming an average consumption of 8 cubic feet per hour, this would give an average user per burner of 690 hours. In 1912, the Company introduced 720 incandescent burners. Assuming that this resulted in a reduction of the consumption all through to about 7 cubic feet, this would make about 790 burning hours per annum. It was probable that the introduction of the mantles did not make such a reduction in the gas consumed as he had named; and this might account for the number of hours being higher than in the previous year. It was fairly clear that electric lamps in institutions of this kind would not have such long hours as gas, because they were more easily turned on and off. Turning to figures already put in regarding renewals in similar institutions of metallic filament lamps, he thought it was agreed that these lamps were renewed once in 2½ years. His own experience was that the average life of the metallic filament lamp was something more than 1000 hours—say, 1200 to 1500 hours. This depended, of course, a great deal upon the way in which they were used and the type of lamp. However, taking the figure at 1000 hours, and that they were renewed every 2½ years, it meant that the user did not exceed 450 to 500 hours per annum per lamp. It was generally accepted, he believed, among engineers who were responsible for electric light undertakings, that the average hours of use per lamp installed in private houses was about 450 per annum. It was suggested that the 2200 gas-burners should be replaced by 2437 electric lamps; and this seemed about right. If they allowed on the average 40 watts for each of these lamps, the illumination would probably be at least double what it was with flat-flame burners; and to provide anything more would certainly be extravagant.

The INSPECTOR: What do you say is the candle power of a 40-watt lamp?

Witness: About 32 candles. This is the figure generally accepted. I find that in a series of tests at the National Physical Laboratory, at the commencement of the run the figure was 28-candle power. The Guardians are purchasing light, not watts. You must keep to candle power. There is certain information I must have before I can report?—The lamps were not run at the full power of 40 watts.

Examination resumed: He assumed an average user of 550 hours per annum, which was higher than the figure based on renewals. This would mean a consumption of 53,600 units per annum, or (say) 54,000 units, which, at 2d. per unit, would cost for current £450 per annum. Including the extra charge of 1d. per unit for power, as already explained, he put the cost at 2·36d. per unit for lighting, which would increase the figure from £450 to £531. Interest and sinking fund charges, over fifteen years, would be £243 18s.; meter-rents, £2 8s.; and renewals, £75. This gave a total of £852 6s. For renewals, he reckoned 1000 lamps per annum at 1s. 6d. each, the price at which he was able to get them. He had tried to see what would probably be the cost of lighting by gas, which was about £1530 per annum with flat-flame burners consuming 8 cubic feet per hour. The Gas Company, he understood, suggested that the greater part of these burners should be replaced by incandescent mantles. A fairly large proportion of them would be fitted with bye-passes consuming something like 1500 cubic feet per annum, which had the effect that, if a 4-feet burner in use 550 hours per annum, and consuming 2200 feet of gas, was fitted with a bye-pass taking 1500 feet, the consumption of the combined burner and bye-pass would be increased to 6¾ cubic feet per hour. Some would not have bye-passes. But those not so fitted would probably be used considerably longer than would be the case if they could be lit up easily; and, therefore, the number of cubic feet consumed per useful burning hour would be increased. Looking at the matter all round, he thought it was a fair assumption that putting in incandescent mantles would probably lower the average consumption of gas over the whole building to 6 cubic feet per burner, which would have the effect of reducing the gas bill from £1530 to £1150 per annum. To this had to be added the Gas Company's charge for maintenance, £134; and the sinking fund charge (on the capital outlay of £725, free of interest, and spread over fifteen years), £48 6s. 8d. This gave a total of £1332. The price the Guardians were asked to pay for lighting by electricity was an exceedingly favourable one. It was somewhat late in the day to discuss the relative advantages of gas and electricity, seeing that so many institutions were now electrically lighted.

Cross-examined by Mr. COLEFAX witness said he believed that Mr. Enright's reports were all based on 16 candles per lamp. For his own calculations, he had taken 32 candles—*i.e.*, 40-watt lamps.

The INSPECTOR: Of course, you know that is not the application before me.

Witness: It does not affect in any way whatever the cost of installation; and my figures of annual outlay come out under those of Mr. Enright, who arrived at the cost in another way.

Further cross-examined, witness admitted that when quoting the price of 40-watt lamps at 1s. 6d. each, he had mistakenly referred to 100-volt lamps, instead of 200-volt ones. For gas, the number of hours' burning would be between 690 to 790 per annum. The 40-watt lamp would do all the lighting required; and if instead of these lamps incandescent burners were fitted, they would consume 6 cubic feet of gas per hour. He was not going to say anything about candle power. If figures put forward by Counsel for gas were correct, the institution would be overlit. What he (witness) had done was simply to arrive at the cost of lighting a certain building. With the improved gas-fittings, he admitted that there would be considerably more light.

Mr. *A. Gay*, the Borough Electrical Engineer, said that at the rate which it was proposed to charge the Guardians there would be a substantial balance of profit to the electricity undertaking. It was important for the borough to increase their business and revenue, and therefore the amount that would go to reduce the rates. The undertaking paid a considerable sum for rates—running into thousands.

Mr. COLEFAX: Published statistics of the undertaking for the year 1913, under the heading of working costs per unit sold, give the charge for rents, rates, and taxes as 0·09d., which is something less than 5 per cent. of 2d. Have you any figure that will check my contention that, so far as the Gas Light and Coke Company are concerned, instead of paying less than 5 per cent. of their gross revenue in rates, they are paying over 10 per cent.? This looks as if they are by far greater benefactors to the ratepayers than the Electricity Supply Committee of the Borough Council?

Witness: Possibly. Answering further questions, he admitted that the total cost per unit last year, including capital charges, &c., was 1·88d. This was taking the average cost of every unit sold. Beyond a certain minimum output, the cost per unit was less.

Mr. COLEFAX: I am going to suggest to Mr. Ekin that, if you are going to do the cabling to the building, and in this way give preference to the Guardians, you must do the same for every consumer?

Witness: It is within the province of the Borough Council to run services if they wish.

If it is part of the bargain to spare the Guardians the cost of this cable, other consumers must be put in the same position?—Not necessarily.

Mr. PETTET said he was anxious to know how they would stand if the electricity supply totally broke down. This had happened more than once already. Further, while there was certain obsolete machinery which was not yet paid for, he did not think it was correct to pay over profits in relief of the rates.

Mr. *Enright* was at this stage re-called, and questioned by the Inspector as to the candle power of the lamps for which he had allowed. He said that he took 20-watt lamps as being sufficient to give the light that was now supplied.

The INSPECTOR: What is the total candle power you intend to instal in the building? I am only dealing with the figures put before me in the application.

Witness replied that he would get the information asked for and hand it in before the inquiry closed.

Mr. COLEFAX: Is it not a fact that, in your reports, when giving the number of units you contemplate will be required for lighting, you have taken 2437 lamps, and have assumed they will be 20-watt ones?

Witness: Yes.

What is the average wattage of the lamps in your specification?—I think it is 20.

The matter has been looked into; and I will tell you what we make it. The lowest wattage in the estimate is 25, and the average is 35?—I do not know that that is so; but I will agree with your figures, if you have worked them out. That will give a much greater candle power than 16.

We have your report and your specification. We know your report is based upon 20 watts; whereas the average of the specification is 35 watts. If 35 watts or any figure above 20 watts is right, it is quite obvious that the number of units which you have taken as the basis of your report, where you estimate the annual charge, will have to be altered?—I doubt it.

The INSPECTOR: All the figures have been based on 20-watt lamps. I had heard nothing about higher power lamps until yesterday.

Mr. *E. H. Curtis*, Engineer-in-Charge at St. John's Road, gave evidence as to the gas-fittings, the amount of gas used for other purposes than lighting, and the machinery used. He expressed the opinion that out of about 1200 gas-lights in the institution with which he was connected, there would certainly be 30 which would require looking after more than once a week.

Mr. *G. Robinson*, the Master at St. John's Road, expressed the opinion that the corridors were so draughty as to be unsuitable for incandescent mantles.

Mr. *W. F. Elmes*, Engineer-in-Charge at Cornwallis Road, said there was room for extending the incandescent gas lighting at the institution. He also dealt with the saving of coal that would result from the introduction of electricity for power.

Third Day.

Mr. *A. Miller*, Engineer of the Hornsey Road Schools, said there were in use there 162 incandescent burners; and this number could be increased. A few of them had been removed owing to their having been tampered with by the children, and because of dust. Perhaps a dozen had been taken out.

Cross-examined by Mr. PETTET: He could not say how they came to be tampered with.

Mr. *G. W. Johnston*, Master of the Schools, said it was the burners themselves, which were provided with bye-passes, that were not satisfactory.

In answer to Mr. PETTET, he expressed the opinion that the burners had not been tampered with, and that the trouble arose from the type of burner which had been put in.

Mr. *Enright* was again re-called, and further questioned by the INSPECTOR as to particulars which he had at previous hearings promised to submit. On taking his seat in the witness chair, he asked that he might have the assistance of his son, who was his partner in business.

The INSPECTOR, refusing the request, said: I have many things to consider; and one of them is whether the gentleman who is advising the Guardians is suitable to carry out the work.

Witness then proceeded to give the numbers of lamps and the powers

now proposed—20, 25, 32, and 55 watts. The total candle power would, he said, be 59,100.

The INSPECTOR: Of course, that is not the figure you placed before me. You based your calculations on an average of 20 watts per lamp.

Witness: Yes; but I find it necessary to add more lamps.

In the application you sent to the Local Government Board, there is a statement made that the consumption per annum is based on a certain number of lamps which consume 20 watts?—The expense will not be in the least altered by having allowed larger lamps in place of the smaller ones.

It entirely upsets your previous application. I have in front of me the figures you gave when I was here last December. By these you showed me how you arrived at a total consumption of 69,792 units per annum. I do not know whether you have forgotten what you told me; but I shall be very glad to refresh your memory. You told me 69 792 units. How did you arrive at that figure?—By taking four hours a day, which was an ample figure.

It entirely vitiates your calculation. You thought in December it was necessary to provide for lamps burning 1460 hours a year. Now, in the new calculation, I do not know how many hours you have taken?—The calculation is the same. I took four hours to set the minds of the Committee at rest.

The average wattage per lamp taken is 31·1, and the average candle power about 24, as against the previous average of 16 candles?—No harm is done. I have given the figures I think most suitable.

But what value can I attach to the figure given in December, which is totally upset when I come here again in May? How do I know that this is right?—If you care to increase the lighting further, you can do so, and the yearly expense would not be nearly as much as I have estimated, while the capital expenditure would be no greater, because the lamps are nearly the same price.

Information was then persistently sought by the Inspector from witness as to how he had arrived at the estimated capital cost of the installation. Some of the information witness confessed his inability to give.

Mr. PRICE: Mr. Enright's son has assisted in the work of preparing the estimates.

The INSPECTOR: I have to test Mr. Enright's capacity to carry out this work; and the farther I get the more uncertain I become.

Mr. COLEFAX: On the 100-volt system, the 20-watt lamp was not made at the date of your report. I ask you now to produce the report (which I have not had yet) in which you change your 100-volt to the 200-volt system.

Witness: It is in the specification.

Then was the specification prepared after your report? No report at all has ever been before the Board for the system of 200 volts?—For two years this specification was in the hands of the Committee.

Mr. *Alfred Walkley*, Vice-Chairman of the Board of Guardians, and Vice-Chairman of the Works Committee of the Metropolitan Asylums Board, gave evidence as to the adoption of the electricity scheme, and said the Guardians had been influenced by the cases of other similar institutions named which showed a saving by adopting electricity in place of gas.

Mr. COLEFAX pointed out that various particulars were wanting to make these comparisons complete.

THE GAS COMPANY'S OFFER.

Mr. *F. W. Goodenough*, Controller of Gas Sales of the Gas Light and Coke Company, stated that the Company were ratepayers in the district to the extent of £16,000 a year, which was about 10 per cent. of the gross revenue. He learned in 1912 that the Guardians were contemplating the installation of electricity in these institutions; and he wrote a letter to the Guardians asking for permission for a representative to meet them before they arrived at a determination in the matter, so that the Company might have an opportunity of placing before them proposals for the modernizing of the existing gas installation. The Company offered to fit up some burners and to maintain them for a period, so that the Committee might have an opportunity of seeing what could be done with up-to-date gas equipment. In May, 1912, he made a report to the Guardians, enclosing specifications and estimate of a complete scheme for the improved and more economical lighting of the institutions by gas. The cost of the installation estimated for was £725 for the three institutions then under discussion. This did not include anything for the receiving homes, as to which the Company had never been asked for information. In that report there was set out an annual saving, on the basis of paying for the installation over five years, of £201. Of course, when the installation was paid for, the saving would be £145 per annum more. The period over which repayment was to be spread had since been altered to fifteen years. The figures named included a fixed quotation for maintenance, of £134 a year. In the winter months, the Company would keep two men constantly in attendance on the premises. They found from experience that one man could quite easily maintain 1200 lights a week, where they were grouped together in big buildings. These two men would be able to thoroughly clean and dust all the burners once a week, and put on any mantles that might be required. They would also be available, while in attendance, to look after any burners that might need attention a second time during the week. Beyond this, it was the Company's practice in the case of large consumers to leave on the premises, in the care of a responsible person, a small stock of mantles for replacing any that might be destroyed during the absence of the maintenance man. Any mantles so used would be replaced by the man on his next attendance. Thus the Guardians would not be involved in any cost for maintenance other than what the men were able to carry out during their working hours. In the summer, there would be one man in constant attendance, because the Company considered attention to each burner once a fortnight would then be sufficient. If additional labour were needed to maintain the burners in a thoroughly satisfactory manner, it would of course be provided. The Company had now under maintenance about 350,000 burners; and the number was constantly growing, because consumers found the system a good one. Then, the Company proposed to give the Guardians a far better light than they had at present—an average of 101,000 candles, in place of 55,000 candles. He did not think the buildings could be adequately lighted on Mr. Enright's original basis of 2400 16 candle power lamps. If they were put in, the size of the lamps (and consequently the consumption of current) would subsequently be increased. This had happened elsewhere. The difference between the calculated cost of the existing lighting (£1333) and the total annual cost of gas in 1911 (£1701)—namely, £368—would represent the cost of gas for cooking and sundry other purposes. Mr. Enright took the figure as £312; but this was materially under-estimated. Under the scheme, there would be a saving of £480 in gas consumption, making the charge for gas £853 a year, to which had to be added £134 for maintenance, and £48 6s. 8d., one-fifteenth of the cost of installation. This gave a total for 101,000-candle power by gas of £1035 6s. 8d. With current at 2d. per unit, the cost of providing 101,000-candle power by electricity would be £1536; while taking the price at 2½d. a sum of £384 would have to be added. This, of course, was for current alone. There was to be added the cost of maintenance, and the repayment of the capital outlay—which outlay he reckoned would not be less than £4000. The incandescent burners would consume from 1¼ to 3½ or 4 cubic feet per hour. One of a large size could consume 6 cubic feet, at an outside pressure. The maximum efficiency of an ordinary incandescent burner at usual pressure started at 27 candles per cubic foot; and the average life of a mantle—that was, the average number of hours the Company allowed a mantle to be in operation before they renewed it when they were responsible for the maintenance—was about 200 to 250 hours. In this time, if the burner was properly looked after, the efficiency should not fall more than 10 per cent. He had, however, taken lower figures. For the installation proposed to be put in, he had assumed an average of 22½ candles per cubic foot. This was the mean between 27 and 18 candles, which would be allowing for a possible deterioration of one-third from the nominal candle power. He had prepared a table of comparative costs of gas and electricity for the lighting of the institutions on various bases of total candle power and hours of lighting. As an example, he had taken 2400 electric lamps, with an average of 35 watts and 25-candle power, which made the candle power 60,000. He took 1050 hours a year, which was rather less than three hours a day, and the fixed quantity of 25,000 units for power. This gave a total (adding renewals and repayment of installation cost) of £1421. For gas, 2400 25-candle power lamps, giving 60,000 candles, reckoning 1250 hours' burning, and including consumption for by-passes, would cost (with maintenance and installation charges) £713. For 100,000-candle power, the figures came out at £1853 and £1026 respectively. This table of calculations demonstrated that the cost of gas would be something like one-half that of electricity. As to the unsuitability of incandescent mantles for lighting such buildings, what was proposed by the Gas Company would certainly prove satisfactory, if they were entrusted with the maintenance. As they knew, mantles were used successfully even for the lighting of railway carriages. They were also satisfactorily employed on pier-heads and seaside promenades. His general experience with regard to the relative cost of gas and electricity was that, light for light, the comparison worked out approximately as shown in his table. In fact, the results in actual practice were more favourable to gas than shown; gas at 2s. 6d. being equal to electricity at somewhere about 1d. a unit. The gas consumption arrived at by Mr. Dykes would give about 230,000-candle power for 700 hours per annum. Mr. Dykes estimated an average consumption of 5 cubic feet per burner; whereas many of those the Company would put in would have a consumption of 1¼ feet per hour. So far as witness knew, there was no justification for saying that £1150 was the proper figure for lighting these buildings efficiently by gas.

In answer to Mr. PRICE, witness said the Company proposed to add 1712 incandescent lights. Those so far fitted had not been put in by the Gas Company. It was quite possible that the burners already installed did not show the saving now suggested for the new ones. For the flat-flame burners in use he thought 5 feet per hour was a fair figure. The average consumption per incandescent burner would be 2 cubic feet. As to the institutions of boards of guardians in the Company's district, he found where the electricity was supplied by a private company, nine out of twelve continued to use gas. Where electricity was supplied by the municipality, one used gas and nine electricity. The inference he drew was that where the board of guardians were entirely free from friendly influence from their borough councils, the guardians continued to use gas. If there was a list of seventeen infirmaries using electricity, some of them must be outside the area of the Gas Light and Coke Company; and he would like to know how many took the current from a borough council. The figure of £182 for maintenance and repayment of cost of installation might be increased to £200 to include the receiving homes, which were not in mind in arriving at the £725 and £132. If, however, the Guardians would give him an order now, he would accept it at the lower figure.

Mr. *H. H. Creasey* said he had made a calculation of the candle power of the existing installations in these institutions, excluding the receiving homes; and the result was that he arrived at a figure of 55,000. He had attended a meeting of the Committee of the Guardians to give information.

Cross-examined: He took a note of every burner; and then went in the evening to see them alight. At the City of London Chest Hospital, Victoria Park, with which he had had to do, they had installed gas in competition with electricity at 2d. per unit; and it had given great satisfaction. He could not say whether the hours of use were at all comparable.

Mr. *Duncan Watson*, an electrical engineer and contractor, said he did not agree that the Guardians could obtain lamps on the terms mentioned by Mr. Dykes. He had read Mr. Enright's reports and specifications; and it would be impossible to get the work done at the prices set forth. In other respects, he criticized the specifications. To carry out the lighting scheme suggested would cost, including engineer's fees, clerk of works, &c., about £4000. For power, he arrived at a figure of 43,000 units, instead of the 14,000 units reckoned for in the scheme. The extra 1d. per unit payable on this current would really bring up the charge on the 60,955 units for lighting to 2 82d. per unit. To his mind a fair yearly average for the use of the lamps would be four hours. For the life of the lamps, 1000 hours was a liberal estimate. Allowing for accidental breakages, &c., 750 hours would be a fair average. For 101,000-candle power by electricity (as was offered

by the Gas Company), the cost for current would be £1715, including the 1d. on 43,000 units taken for power at 2d.

Mr. COLEFAX, summing up, referred first to the initial cost of the electrical installation. Figures had, he said, been put before the Inspector from which it would appear that the estimated cost of the lighting scheme was £2830; but the evidence proved that this was in no way justified. Mr. Enright had supplied no particulars on which such an estimate could be justified. The cost stated came to 23s. 6d. per point; and nothing at all approaching this figure could be found in other cases. Mr. Goodenough had quoted a recent instance in which the figure was 43s. 6d. Mr. Watson said 35s., and that another 10s. should be added to make a satisfactory job. Looking at everything, he maintained that £4000 was a fair estimate of the cost. The suggested charge of a 2d. flat-rate was absurd, because anybody could get power at 1d. per unit and light at 3d.; and if they used as much current for power as for light, they would be paying the ordinary rates of 1d. and 3d. The figures put forward that day were genuine ones; and they seemed to show that the cost of electricity and gas were in the proportions of about 9 to 5 as an annual charge. The figure which really tested the position was the £1150; and Mr. Goodenough had told them that for this the institutions would be enjoying something over 200,000 candle power instead of the 55,000 to-day. It was suggested that there would be some saving by adopting electricity for power; but it seemed the minimum requirement of current would be more than the minimum of 25,000 units, for which they had to pay an extra 1d. This would negative any saving of coal. There was room for doubt as to whether the Borough Council could do what they were proposing. He did not see how they could make it part and parcel of their bargain that they would bring the cables into these buildings, charging a flat-rate of 2d., unless they were prepared to charge other customers the same and take the cables in for them; and this, he imagined, was not the intention of the Borough Council.

Mr. PEALLING said he objected to this excessive amount of money being spent on electric lighting. Gas lighting was much cheaper than what it was proposed to do.

Mr. PETTET remarked that he appeared as representing rather more than one-third of the present Board of Guardians—that was, those who signed the memorial sent in to the Local Government Board praying for this inquiry. Right from the inception of the scheme, the Committee had had a difficulty in getting at any definite figures regarding the real cost. At pretty well every committee meeting, he had tackled Mr. Enright on some figure or another; and he had never in any single instance been able to get the information he wanted. Now he could understand the reason for all this. The inquiry had been justified by the fact that it had borne out the contention that Mr. Enright's figures were wrong in every shape and form. Another reason for his objection was the difficulty experienced in coming to any businesslike arrangement with the Borough Council. There had been a shifting of position all the way through. It was admitted that, if the arrangement was entered into, the Guardians would probably have to pay £84 13s. a year for current for power they did not use. Would any business firm agree to such a thing? Again, he objected to the scheme because the Board referred to the Committee the consideration of two proposals—for electricity and for gas; and in no single instance had the proposal for gas been considered in detail. He believed he was the only member of the Committee at present who had ever gone line by line through the schedules of the Gas Company. Some had never seen them.

Mr. BRAMALL, in reply, pointed out that it did not matter in the least to any ratepayer what the Guardians paid to the Borough Council for electricity, because the ratepayers behind both bodies were precisely the same. Even on the outside figures advanced by the Gas Company, it would be cheaper for the Guardians to have electricity than gas for lighting, if they bore in mind what was the actual cost of the current.

Mr. PRICE said the Gas Company had raised three points. The first was that the installation could not be carried out at the price named in the report to the Guardians; secondly, that there would be an increased saving by using gas instead of electricity; and, thirdly, that with gas there would be a saving in the maintenance charge. Much evidence had been given there with regard to the specification; and he would leave this matter. With reference to annual charges, it seemed that Mr. Enright's figures were not much out. He had increased his 20-watt lamps to 40-watt ones, and yet brought his units down from 60,000 to 45,000. As to the maintenance estimate, this had been justified by the figures produced from other institutions. Mr. Enright's judgment was right in this, as in other matters; it was his reasons that were wrong. He did not think the Guardians could be charged with remissness in their dealings with the proposal of the Gas Company.

The INSPECTOR thanked those present for their attendance; and the three days' proceedings were brought to an end about half-past seven.

Monte Video Gas Company, Limited.—The forty-second ordinary general meeting of this Company will be held to-morrow (Wednesday), when the Directors will submit the statement of accounts for the year 1913. The profit was £26,311; and after providing for interest on the debenture stock, income-tax, bad and doubtful debts, and depreciation of capital, the balance available for dividend is £34,518. An interim dividend has been paid for the first half of the year, of 6s. per share; and the Board now recommend the payment of a further amount of 10s. per share, also less income-tax, making together a dividend of 4 per cent. This will absorb the sum of £21,677, and leave a balance of £12,841 to be carried forward. The reserve account remains at £32,000; the contingency account stands at £18,663; and the insurance fund at £12,500. The sales of gas continued to expand satisfactorily; the total showing an increase of 9·75 per cent. compared with the preceding year. The profit from the sales of coke and coal was less, owing to extreme competition among the coal importers during the closing months of the year. But the revenue from the dock department was fully maintained. The Directors announce with regret that the Chairman, Mr. Thomas C. Tatham, who had been a Director of the Company for over 30 years, died last March, and Mr. Charles Hunt had been appointed Chairman in his stead.

RUSHING THROUGH A CONTRACT.

Electric Light for a Norwood Infirmary.

At a Meeting of the Lambeth Board of Guardians on Friday, it was reported that the South Metropolitan Electric Supply Corporation had commenced the work of wiring for the installation of the electric light in the Children's Infirmary at Norwood. At the previous meeting, the Board accepted their tender for the work; but Mr. Kinnaird gave notice that he would move that the resolution accepting the tender be rescinded. The South Metropolitan Gas Company had some time ago been instructed to instal new gas-fittings; but the order was held back on the suggestion of the Master of the institution, in order that the estimates for electric lighting might be obtained. When these were before the Board, it was decided that they should be referred to a Committee; but meanwhile the Committee gave instructions for the installation of the electric light to be without delay proceeded with.

Mr. KINNAIRD, in moving that the Board rescind the previous resolution, in order that they might obtain the relative cost of gas and electricity for lighting and other purposes, said he was astonished when he heard that the contract for the electric light installation had been signed and sealed. Was it the practice of the Board, he asked, directly a tender had been accepted, to give notice to the firm that had sent it in to at once proceed with the work? If so, why had not the same rule applied to the tender of the Gas Company? The electricity scheme would cost £237, and the gas scheme only £35. Then there was the question of upkeep, which had never been considered by the Board. No one knew how much more, in any given circumstances, electricity would cost than gas.

Mr. NARRACOTT seconded, and asked if the resolution accepting the tender of the South Metropolitan Gas Company for new gas fittings had been rescinded. Many members were under the impression that no decision had been arrived at to instal the electric light.

Captain THIMM said the question of installing a special gas lighting system came up for consideration before the Committee; and it was then presumed it would be accepted. A little later, and before the next meeting of the Committee, the Electric Supply Corporation were laying mains in Norwood Road, and an offer was made to run the mains free of cost to any building attached to the schools—the Corporation to make good the roads. At the time it was specially stipulated that the Board should be free whenever they wished to call for public tenders for the wiring of any of the buildings. In the meantime, pending the cables being run in, it was decided to hold over any tenders for gas installation until the Committee had received tenders for the installation of the electric light. The tenders eventually arrived, and each one was carefully considered. The lowest was that of the South Metropolitan Electric Supply Corporation; and it was accepted. If the electric light was intelligently used, it was cheaper than gas.

The CHAIRMAN (Mr. Frank Briant) pointed out that the contract had been signed and the work commenced. All that could now be done was to cancel the contract with the Electric Supply Corporation. They might claim damages.

Mr. KINNAIRD remarked that even now, if they stopped the electric wiring and paid the Corporation £100, it would be cheaper for the Guardians.

The resolution of Mr. Kinnaird to cancel the contract was defeated by five votes to fourteen.

THE ELECTRICAL PRESS AND THE LONG EATON JUDGMENT.

As was to be expected, some of the papers dealing with matters electrical comment on the judgment given last week in the Long Eaton Gas Company's case [reported in "Legal Intelligence" to-day]; and some extracts may be made from our contemporaries' views. But first of all we reproduce a letter to the "Electrician" by the Chairman of the South Metropolitan Gas Company, Mr. Charles Carpenter, D.Sc.

He writes: It has been suggested upon more than one occasion in the Electrical Press that gas undertakings and suppliers of electrical energy should work in greater harmony than is customary at present. This must be my excuse for troubling you with this letter, in which I desire to point out that the decision given by Mr. Justice Sargant in the Court of Chancery upon the Long Eaton case is not likely to hinder such a consummation. However desirable it may have appeared to some suppliers of electrical energy that gas undertakings should be wiped-out of existence, they were never given their statutory powers for such an object. In this fundamental respect they differ from an ordinary trader, who is free to sell his goods to any customer he chooses, and at whatever price he chooses, and to go any length in this direction even if his avowed object be to smash-up the opposition shop in the same street. If energy suppliers will but take to heart the difference between fair and unfair trading (or preference) they will get their share of the supply of light, heat, and power, in response to the demand the public makes for it, which was the privilege Parliament meant to bestow when it gave them their statutory powers.

In their "Editorial Note" on the case, the "Electrician" writes: It is not surprising that judgment was given against the Council; it being held that there was a breach of both sections 19 and 20 of the Electric Lighting Act of 1882, which stipulates that there must not be preference. We suggest that the policy followed by the Council was altogether short-sighted. In our opinion, it is far better to give consumers a free hand. So long as electrical energy is used for a definite purpose, and is paid for on that understanding, there should be no question whether the consumer uses other systems of light and power. Any regulations of a throttling character are irksome, and will be strongly resented. Besides, the powers of an electricity undertaking should not, as pointed out by Mr. Carpenter in our correspondence columns,

be used for the purpose of stifling competition. We can afford to do without this sort of thing. We submit, therefore, that any other policy than one of freedom in use only does harm in the long run; and we trust that other supply undertakings will take the present lesson to heart, if they are thinking of adopting what may be termed penalizing tariffs. In some quarters there seems to be a tendency to become alarmed at the judgment; but this attitude is wholly unwarranted.

The "Electrical Times" writes: A decision of this nature must come as a shock to statutory electric supply undertakers; but in our opinion station chiefs have no need to fear that they must set about a general revision of their tariff methods. For one thing, there may be an appeal. For another, the case (as Mr. Justice Sargant was careful to point out) really resolved itself into one of fact—both parties being agreed on the general principle that "if the combination of lighting or exclusive lighting would make the supply of power or of power and partial lighting to the consumer in question less costly or more profitable, then there would be a justification for reducing the charge to A as compared with B." What the Long Eaton Council did was to adopt a particularly clumsy expedient for inducing factory owners to use electricity for light as well as power. . . . Small wonder that the local Gas Company seized the chance of going to law, *vid* the Attorney-General. . . . It only remains to share the Judge's implied regret at the paucity of the technical evidence offered. None was forthcoming from the Gas Company, and that put forward by the Council is described as "extremely thin." The opinion was expressed that "should the same sort of question be fought out again with reference to a larger undertaking, there would be room for very much fuller and more complete technical evidence on both sides." Which opinion we cordially endorse. The effect of the present judgment, which was necessarily arrived at on such scanty materials as were available, must be to unsettle and hamper those responsible for framing electricity tariffs in this country; and we trust that, if an appeal be entered, this most intricate question, which has so direct a bearing on the commercial development of our industry, will be very thoroughly and comprehensively examined from the technical side.

HOME-PRODUCED MOTOR FUELS.

Ballycastle Cannel Treated by the Del Monte Process.

Last Tuesday's issue of the "Motor" gives in full a report of a test carried out on Ballycastle cannel under the Del Monte process, and which has led to an expression of opinion by Mr. W. J. Atkinson Butterfield, M.A., F.I.C., &c., that the "process and plant in its present form can utilize cannel for the production of oil more economically and efficiently than any other known process and plant."

Our contemporary points out that in the test a ton of cannel from the Ballycastle property yielded 58·5 gallons of crude oil. In the estimate which Mr. Butterfield prepared and which they published in full he makes an abatement of 15 per cent. in order to cover every contingency, including a possible reduction in the quality of the cannel as the working of the seam advances, corresponding to a reduction in the yield of crude oil to (in round figures) 50 gallons per ton. Mr. Butterfield has no reason for believing that the average yield of crude oil per ton of cannel will be less than the 58·5 gallons which he obtained. The report is lengthy and highly technical; and it is not necessary to give it here in full. The yield of motor spirit is 17·4 gallons per ton of cannel from the Ballycastle (Ireland) mine.

In their issue dated March 10, the "Motor" mentioned that the yield of 20 gallons of spirit per ton was referred to as having been claimed last year. The quantity thus alluded to as available was after "cracking" the heavy oil yield to the utmost. Such a proceeding is not always commercially practicable, as sometimes it does not pay to crack to the utmost and so sacrifice other valuable products. The new figures are on a strictly commercial basis and are given on the authority of practical experts.

Our contemporary says it is not concerned with the financial developments which are understood to be pending, but with the process itself. The great point is that, now that the experts have made their reports, it can be regarded as practically certain that enormous quantities of home-produced motor spirit can be obtained from cannel coal, shale, and ordinary coal, from many quarters and at a price that will compete effectually with imported motor spirit.

According to Mr. Butterfield's estimate, "if the motor spirit were regarded as a bye-product of the process, and the other products were sold at current market values, the cost of production of the motor spirit would be less than 1½d. per gallon."

The following is Mr. Butterfield's estimate in full :—

Gentlemen,—In accordance with your wishes, I have pleasure in giving my estimate of the profits derivable from the treatment of Ballycastle cannel by the Del Monte process. In so far as the plant and mode of working depart from common practice, I have obtained confirmatory estimates of capital outlay and working expenses from persons and firms having special acquaintance with the particular plants.

My estimate is based on the yields of products obtained by me in a test in a full-sized Del Monte plant from a sample of Ballycastle cannel, which I received from Mr. Robert Elder, M.I.M.E. The results of this test have been given in detail in a report by me dated April 27, 1914.

I have taken the cost of the cannel at the maximum figure given by Mr. Elder—viz., 7s. per ton on the works. I have assumed that the installation, composed of Del Monte plants for the treatment of 500 tons of cannel per diem, with adequate oil distilling, refining, and cracking plant, and producers to gasify, in ammonia recovery conditions, all the coke obtained, will be erected at Ballycastle, near the pit's mouth—free sites being available.

The producer plant will yield about 68,000 cubic feet of gas per ton of cannel. Not more than 10,000 cubic feet of this gas may be required, in addition to the stripped retort gas, as fuel for the retorting plant, and about 38,000 cubic feet will be utilized as fuel in the distilling, cracking, and refining plant, leaving a surplus which will more than suffice for the fuel requirements of the mining department and for the general heating, power, and lighting needs of the works.

The estimate of costs and revenue is attached. It shows that, on the basis of a throughput of 500 tons of Ballycastle cannel per diem, the net profit, after providing for depreciation and renewals of plant, but not for interest on capital outlay, will amount to £112,894 per annum. Under manufacturing charges no allowance has been made for the cost of fuel, since, as explained above, the whole fuel requirements are obtained from the stripped retort gas and the producer plant, which is fed with the coke from the retorts.

If the motor spirit were regarded as a bye-product of the process and the other products were sold at current market values, the cost of production of the motor spirit would be less than 1½d. per gallon. The difference between this figure and the actual price obtained for motor spirit sold f.o.b. in bulk at Ballycastle should be net profit to the undertaking.

While I have no reason to believe that, in the actual exploitation to which this estimate refers, the average yield of crude oil per ton of cannel will be less than 58·5 gallons which I obtained, I consider that every contingency, including the possible reduction of quality of the cannel as the working of the seam advances, would be amply provided for by an abatement of 15 per cent., corresponding to a reduction in the yield of crude oil to (in round figures) 50 gallons per ton. On the basis of this reduced yield, the net profit would be £86,550 per annum.

(Signed) W. J. Atkinson Butterfield.

Estimate of Profits, on the Basis of a Throughput of 500 Tons of the Ballycastle Cannel per Diem.

Costs.

	Per Ton of Cannel. s. d.		Per Annum. £
Cannel delivered to retorts	7 0	..	63,000
Retorting: Labour, management, and all other manufacturing charges	1 0	..	9,000
Distillation of crude oil: Leaving residuum of pitch; cracking portion of distillate and refining into motor spirit; recovering and refining of paraffin wax from heavy distillate, leaving heavy fuel oil. Labour, management, and all refining charges, at 0·75d. per gallon of crude oil	3 7·9	..	32,906
Manufacture of producer gas and sulphate of ammonia, labour, acid, management, and all other charges	3 0	..	27,000
Depreciation and renewals at 15 per cent. per annum on total cost of plant—viz., £185,000. [of which £50,000 is for the retorting plant, £30,000 for the crude oil distilling and wax extraction and refining plant, £20,000 for the cracking and spirit refining plant, £80,000 for the producer and ammonia recovery plant, and £5000 for incidental expenses.]	3 1	..	27,750
	17 8·9	..	159,656
Net profit	12 6·5	..	112,894
Totals	£1 10 3·4	..	£272,550

Revenue.

	Per Ton of Cannel. s. d.		Per Annum. £
17·4 gallons (per ton of cannel) of motor spirit at 10d. per gallon	14 6·0	..	130,500
17·6 gallons of heavy fuel oil at 3d. per gallon	4 4·8	..	39,600
37·5 lbs. of paraffin wax at 1¼d. per lb.	4 8·2	..	42,150
51 lbs. of pitch at 35s. per ton (⅞d. per lb.)	0 9·6	..	7,200
54½ lbs. of sulphate of ammonia at £12 1s. 6d. per ton (1·3d. per lb.)	5 10·8	..	53,100
Totals	£1 10 3·4	..	£272,550

It seems that a limited "press view" of the process—at all events an invitation to attend did not reach the "Journal" offices—took place on Monday last week; and the following short notice appeared in "The Times" next day.

A demonstration was given yesterday by the Oil and Carbon Products, Limited, of the new form of plant for the carbonization of coal according to the Del Monte process, which they have erected at Chiswick. There are five retorts in all, one standing alone, while the other four are combined in a bunch with common feeding and discharging appliances. The retorts consists of long mild steel tubes, inclined at a slight angle to the horizontal. The coal or other material under treatment is fed in at the lower end, and slowly traversed up the tube by means of an archimedean screw. A tube passes through the middle of the screw; and into it from the upper end air and gas are injected and burnt. At the same time the exterior of the tube containing the screw is heated by a series of gas-burners, so that the coal is heated on both sides, and no portion of it is more than 1½ or 2 inches from a source of heat. The temperature is so regulated that it increases from the lower end to a point beyond the middle, but falls off again at the top. The temperatures employed for carbonization range from 900° to 1300° Fahr., but are varied to suit the particular material under treatment. When the retorts are in operation, a stream of cold gas is passed in at the upper end and sweeps right through to the lower end. The purpose of this arrangement is to carry off the hydrocarbons that are liberated by the distillation, at the temperature of their formation, and sweep them down to the cooler part of the retort, where they are condensed. The advantage is claimed that in this way the useful yield is increased; the hydrocarbons not being subjected, as in other processes of carbonization, to high temperatures which break them down. The gas obtained is stated to be more than sufficient for firing the retorts and for all other purposes connected with the working of the plant.

THE LIVERPOOL GAS COMPANY TO PURCHASE THE FAZAKERLEY GAS-WORKS.

A Parliamentary Deal.

The Parliamentary Committee of the Liverpool City Council, at their meeting last Wednesday, unanimously came to the important decision to dispose of their Fazakerley Gas-Works to the Liverpool United Gaslight Company.

For some time, it is said, the Committee have had this matter under consideration. It is no secret that consumers in the district have not been satisfied with the quality of gas which has been supplied from the Fazakerley works; and there has also been grumbling at the price charged. These considerations, it is understood, have weighed with the Committee in taking the step mentioned; and the conclusion come to was that more satisfactory results might be obtained if a transfer could be effected to the Company.

The Fazakerley works are the only gas-making plant owned by the Corporation; and they were erected for the purpose of serving the Fazakerley district exclusively, before any other means of supplying gas to the neighbourhood existed.

The Committee's recommendation will be considered at a special meeting of the City Council to be held to-morrow (Wednesday).

NOTTINGHAM GAS UNDERTAKING.

Reduction of Price and Further Expenditure.

Some important proposals were foreshadowed in the annual report of the Nottingham Corporation Gas Committee presented at a meeting of the Council held yesterday. There have been of late persistent demands made in the city for a reduction of price, and much has been heard of the claims of slot-meter users to a larger measure of consideration. Although, with the enhanced cost of coal and the smaller profits derivable from residuals, it was not expected that much in the way of reduction of price could at present be effected locally, the Committee have decided upon concessions to both classes of consumers. The most important matter in the report relates to the further process of remodelling to be carried out at the Radford depôt of the Corporation, where an instalment of Glover-West plant was recently inaugurated.

The report does not indicate specifically whether, in regard to the projected process of reconstruction, the same type of appliances is to be further extended; but an additional expenditure of £70,000 is contemplated to bring the works up-to-date—the advantage of the utilization of the Radford site being that the operations can be carried out there without interfering in any way with the present larger sources of supply at the Basford and London Road works. Upon the question of the superiority as between continuous and intermittent verticals it will be observed that Mr. Wilkinson's report (which is given below) contains a significant paragraph. The Committee indicate still more extensive reconstruction processes at Basford—the principal carbonizing station; and the sound policy, for which the present Chairman has been responsible, of meeting out of the special renewals account the extraordinary expenditure which will thereby be involved, without touching reserve funds, is emphasized by the report.

The year's results attained again constitute a record in the history of the undertaking; and how much the City Exchequer is dependent upon the profits from the gas undertaking is shown by the fact that in a year in which the Council is faced with the necessity of adding 1d. to the district rate—making the total local imposts for all purposes 8s. 6d. in the pound—it is again proposed to take the large sum of £39,000 from the gas profits.

The consumption of gas last year was 82,651,000 cubic feet more than at any other period in the history of the department; the figures for the last twelve months being 2,251,302,700 cubic feet, against 2,168,656,700 feet in the previous annual period. The total income for the year amounted to £382,911 16s. 6d., and the expenditure to £250,995 2s. 9d.; leaving a balance of £131,916 13s. 9d. to be carried to the profit and loss account. After deducting interest on capital and contributions to the sinking funds, and placing £2500 to the depreciation of stoves, there remains a balance, including bank interest, of £75,426 12s. 8d. at the disposal of the Council. The Committee, as already indicated, recommend that out of this sum £39,000 be handed over to the Finance Committee in aid of the general district rate, £30,000 be placed to the renewals fund, £2000 to the reserve fund, and the balance of £4426 12s. 8d. be carried forward. The Committee point out that, in the report for the year ended March 31, 1913, it was recommended that the balance of £6063 should be carried forward to this year; but as the Council on Nov. 24 resolved that the property in the Exchange block (to form a site for the proposed erection of a new Town Hall) should be purchased and paid for out of the reserve fund of the gas undertaking, and there not being sufficient surplus cash in the reserve account for the purpose, the amount referred to was transferred to the reserve fund, to enable the Committee to carry the resolution of the Council into effect.

The markets for coke, pitch, sulphate of ammonia, and all other residuals, with the exception of creosote, have been most unsatisfactory during the latter half of the year, and will seriously affect the profits of next year, unless there is a general rise in prices, which is most unlikely. The Committee report the completion of the first section of the vertical retorts at Radford works, which has resulted in considerable economies in the cost of manufacture. The installation is still in the hands of the Contractors. It is the intention of the Committee to entirely remodel and extend the Radford works out of the special renewals fund. To complete the work will cost a further £70,000. The various gas and chemical works and the distribution department are in good condition; large sums having been spent on renewals during the year. The Committee recognize, however, the importance of contributing to the special renewals fund such amounts as will, in the near future, enable them to turn their attention to making the Basford works an up-to-date gas manufacturing station. The amount of gas sold constitutes a record for Nottingham. The profits, as indicated, are also larger than for any other year in the history of the undertaking. The amount of gas sold per ton of coal carbonized was 11,623 cubic feet, as against 11,059 cubic feet last year and 9549 cubic feet in 1904. It has been decided to reduce the price of gas 1d. per 1000 cubic feet to all ordinary consumers and to give an additional rebate of ½d. in the shilling to all prepayment consumers from Jan. 1 next—being equivalent to a reduction of 1¾d. per 1000 cubic feet. These concessions will absorb £11,000 per annum. The Committee feel that these reductions in price are preferable, and far more to the advantage of the consumers, than the abolition of meter-rents.

The Engineer's Report.

The document accompanying the Committee's statement represents the third annual report as to the working of the undertaking for which Mr. John Wilkinson, the Engineer and Manager, has been responsible—he having had thus the felicity of participating in another record year. As to the manufacturing department, Mr. Wilkinson states that during the period under review 190,025 tons of coal and 131,911 gallons of oil were carbonized in manufacturing the following products: Coal gas 2,288,595,000 cubic feet, water gas 44,281,000 cubic feet, or a total of 2,332,876,000; water gas equalling 1·9 per cent. of the total quantity made.

The amount of tar distilled at the Giltbrook chemical-works was 9182 tons, which yielded products as follows: Crude naphtha, 57,462 gallons; crude carbolic, 13,673 gallons; creosote, 447,494 gallons; brick oil, 30,900 gallons; pitch, 5764 tons; naphthalene, 186 tons; and ammoniacal liquor (10-oz.) 856 tons. In addition to the above, 92,855 gallons, or 464 tons, of crude tar and 24,882 gallons of creosote were used for the manufacture of 117,737 gallons of specially prepared tar for roads. The Giltbrook works were also used for the manufacture of 2970 tons of sulphuric acid (100 per cent.) and 1601 tons of oxide of iron for purification purposes. At the Basford ammonia-works, the equivalent of 30,710 gallons of 10-oz. ammoniacal liquor was distilled during the year, producing 2319 tons of sulphate of ammonia.

The first four beds of vertical retorts at Radford were brought into use on Oct. 31 last, and the whole installation has been in continuous operation since Nov. 23. The installation has not yet been taken over from the Contractors, the agreement having provided for certain working results being obtained before the Contractors can be relieved of their responsibility. The general work, Mr. Wilkinson reports, is good; "but it is essential that an extended experience of the plant should be obtained before embarking upon the second portion of the reconstruction scheme at Basford. The success of vertical retorts is now assured. But the question of superiority as between continuous verticals and intermittent verticals is still an open one; and we are now concentrating our attention upon the coking properties of local coals when carbonized by the two respective systems." The whole of the railway sidings at Radford have been re-arranged and re-constructed; giving additional shunting and storage accommodation.

In relation to the Distribution Department, the following are the details of the sale of gas during the year: Ordinary consumers, 1,605,302,300 cubic feet; prepayment consumers, 543,856,900 cubic feet; public lamps, 102,143,500 cubic feet—total 2,251,302,700. These figures compare very favourably with the total sale the previous year—viz., 2,168,651,700 cubic feet—indicating an increase of 82,651,000 cubic feet, or 3 81 per cent. The following are the comparative receipts for gas sold: Year ended March 31 last, £273,633; year ended March 31, 1913, £262,592—increase, £11,071. The gas unaccounted for during the year was 81,573,300 cubic feet, or 3·50 per cent., as compared with 42,201,300 cubic feet, or 1·91 per cent. for the previous year. The percentage of 3·50, Mr. Wilkinson observes, is higher than anticipated. As pointed out in his last report, however, the percentages for the two previous years were abnormally low. Atmospheric conditions and the overlapping of the quarterly readings of the meters, affect the percentage of gas unaccounted-for from year to year; and exceptional figures, he adds, will periodically occur. On the other hand, it should be pointed out that the increased pressures now being given throughout the area of supply will result in permanently higher percentages of unaccounted-for gas. It is interesting to note that the actual sale of gas per ton of coal carbonized is now over 2000 cubic feet in excess of the figures attained ten years ago—viz., 1914, 11,623 cubic feet; 1904, 9549 cubic feet. There were connected to the mains during the year 1694 additional consumers—making a total of 81,436 consumers at March 31.

The number of public lamps in use at the same date was 8048. The average consumption per consumer equalled 26,057 cubic feet, as compared with 25,572 cubic feet in the previous year. The total length of mains laid at March 31 was 401·91 miles; 4·09 miles having been added to the canalization during the year. The number of new gas services connected to the mains was 1842, against 2073 the previous year. The number of meters fixed to March 31, including 488 lamp meters, was 81,924; being an increase of 1690 on the previous year. The Gas Department own 79,133 of the meters, and 2791 belong to the consumers. The demand for prepayment meters still continues; and at the end of the financial year 41,722 of these were in operation—an increase of 1011 on the previous year. The application of gas for trade and domestic purposes, other than for lighting, continues to increase. At March 31 there were in use (about): Gas cooking-stoves, 33,721; gas-fires, 17,353; gas-engines, 865. Of the 33,721 cookers fixed, 9583 were rented from the department and 23,404 supplied rent free with the automatic meters. There are also a large number of other appliances of almost every description which have not been summarized. The orders and calls for attention of various kinds from consumers numbered 86,808, against 87,567 the previous year.

Some interesting figures are embodied in Mr. Wilkinson's report showing, in tabulated form, the number of complaints, excluding those due to naphthalene deposits, which were received during each of the last ten years, and their relation to the number of meters in use. The increase in the number of prepayment meters will, he observes, naturally tend to increase the percentage of complaints received, as a large proportion of the complaints are traceable to consumers' attempts

to insert misshapen coins into the coin-receiving mechanism of the meters. The work in connection with the laying of auxiliary mains to supply the Ruddington district (a rapidly-growing residential suburb near Nottingham) has been commenced, and will be completed during the present summer. Additional main-laying operations in other districts will also become necessary from time to time, and increased expenditure for this purpose may be anticipated. Strict attention has been paid to the manufacturing operations at the respective gas and chemical works, and the results obtained will bear comparison with those of other undertakings of similar size. During the year the Committee had been able to make special contracts for the disposal of a fairly large tonnage of coke made from local coals, which had the effect of materially reducing the average cost of coal. They had not, however, been able to make similar contracts for the present year. The financial returns benefited to a large extent by the favourable contracts made some time ago for the forward purchase of coal and the sale of coke and other residuals. But the outlook for these materials, so far as gas undertakings are concerned, is anything but encouraging. Coal prices are substantially higher; and the prices of all residuals, creosote excepted, have suffered a serious fall. The expenditures for coal and receipts for residuals during the last three years were:

	Expenditure for Coal	Receipts for Residuals.
Year ended March 31, 1914. . . .	£111,013 ..	£94,326
" " " 1913. . . .	£102,023 ..	£98,791
" " " 1912. . . .	£89,045 ..	£81,226

The actual result of the revenue account for the past year is represented as follows: Total receipts, £382,912; total expenditure, £250,995; gross profit, £131,917. The gross profit for the previous year was £129,305, and £106,595 for the year ended March, 1912.

Annexed to the report are tables showing the development of the undertaking during the last ten years and the comparative workings per ton of coal and per 1000 cubic feet of gas sold for the years ended March 31, 1913 and 1914.

Some Interesting Figures.

In relation to the finances of the undertaking, the accounts supply some interesting figures, showing that the annuity capital is now represented by £312,300. The nominal value of an annuity is £50, yielding £3 5s. annually. There had been repurchased 996 at a total cost of £57,134. The loan capital is represented by £230,667, the debenture capital by £55,520, and the consolidated stock by £452,904; making, with the annuity capital already mentioned, a total capital of £1,051,392 invested in the undertaking. This is a sufficiently large stake to warrant the idea that the revenue of the undertaking should not be dealt with quite so freely as some members of the Council are prone to suggest. A sum of £174,617 was spent last year on the manufacture of gas, and £41,124 in expenses incidental to its distribution. The chief items in the first-named amount were £111,013, representing the cost of coals, including carriage, unloading, and expenses of depositing on works; £42,558 for repair and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour; £15,767 for wages (carbonizing), £2375 for purifying (including £1339 for labour), and £2957 for salaries at the works. Rates and taxes swallowed up £24,013; management expenses accounting for £10,256. The renewals account shows a total available on March 31 of £54,157. The reserve fund and rest account stands at £173,212.

At the meeting of the Nottingham Town Council yesterday the preceding reports were accepted.

GAS AND ELECTRICITY IN BIRMINGHAM.

The Birmingham Gas Committee recently drew up their report for presentation to the Council; and this was done at a special meeting held yesterday. The report contained the statement of accounts for the year ended the 31st of March last; and at the close of the meeting the Chairman (Sir Hallewell Rogers) said it had been decided to hand over to the City Treasurer for the relief of the rates £65,584, in addition to £3292, the interest on the reserve fund. Last year the amount given to the relief of the rates by the department, irrespective of the interest on the reserve fund, was £77,725; so that the contribution this time is £12,141 less than a year ago. But as the department have had to pay £4551 more in rates and taxes, owing to increased assessments, the decreased contribution actually is only £7590. This decrease is more than accounted for by the increased cost of coal and oil, which has caused the working expenses of the department to be much heavier than usual. The extra expenditure has amounted to about £100,000. There has been an increased output of gas in Birmingham during the year, which has enabled the department to meet the extra charges.

Referring to the manufacturing plant, the Committee state that the horizontal retorts in No. 3 house at Swan Village are quite worn out; and they have decided to instal vertical retorts of the Woodall-Duckham type, as similar plant recently erected at the Windsor Street station is working smoothly and giving satisfaction. A table appended to the report shows that the quantity of gas sold last year was 9,551,783,300 cubic feet, compared with 8,773,044,600 cubic feet in 1912-13; being an increase of 778,738,700 cubic feet, or 8·8 per cent. There were 17,744 additional cooking and heating stoves sold during the year and on hire on March 31; the total number of cookers supplied to prepayment consumers at that date being 86,116—an increase of 7173. There was also an augmentation in the number of prepayment meters fixed—viz., from 89,028 to 94 442, or 5414 more.

The accounts show that a sum of £772,436 was received for gas; the sale of residuals produced £365 643; the sale and rent of fittings and stoves, £12,409; and the total revenue was £1,157,070, compared with £1,072,040 the preceding year. The expenditure on the manufacture of gas was £785,400; on distribution, £91,323; and on management, £12,739—the total being £970,800, compared with £881,398. The sum carried to the net revenue account is £186,270, against £190,643; and, as stated above, the balance of profit is £65,584.

The Electric Supply Committee also met, and prepared their report for submission to the Council. Included in the report was the statement of accounts for the year ending March 31; and the Chairman (Mr. Ellaway) stated at the close of the meeting that it was proposed to hand over to the City Treasurer, in relief of the rates £25,134, besides carrying to the renewals fund £19,500. These figures show that the profit on the year's trading amounted to £44,634, against a total last year of £27,600, of which £6000 was applied to the renewals fund, and £21,600 contributed in relief of the rates. Twelve months ago completed the first year since the reduced charges for current had been in operation; and the increased output of 17½ per cent. during the past year had enabled the department practically to recover from this reduction. The department have also suffered from the higher cost of fuel, materials, and wages, which came to £13,000 more than in the previous year.

STAFFORD MUNICIPAL UNDERTAKINGS.

The Stafford Town Council have had before them the reports for the past financial year of the gas, electricity, and water undertakings.

The annual report of the Gas and Electricity Committee showed that the total revenue was £39,059, an increase of £1426 on the previous year. After meeting the capital charges, there was a net profit of £5027, £2000 of which was set aside for the district fund in aid of the rates, £2000 was placed to the reserve fund, while a sum representing 10½ per cent. on the wages paid was for the profit-sharing scheme in connection with the works. The income of the Electricity Department was £6379, and the expenditure £3934, leaving a gross profit of £2444—a decrease of £35 compared with the previous year. A sum of £2397 was transferred to meet capital and other charges, with £257 to be carried forward.

The Water-Works Committee had an income of £7200, an increase of £308; and the expenditure, including £940 for deprecation, was £3017, a decrease of £260. The gross profit was £4343. The capital charges amounted to £3227, and the available balance was £1106. It was proposed to place £1000 to the credit of the district fund in aid of the rates, and to carry forward £106.

ROTHERHAM CORPORATION GAS UNDERTAKING.

Report of the Engineer and General Manager.

There has been presented to the Rotherham Gas Committee by Mr. J. S. Naylor (the Engineer and General Manager) his report on the operations of the Gas Department for the year ended March 31.

The quantity of coal carbonized during the year was 27,385 tons, at a cost of £17,179, or 12s. 6·55d. per ton, as against 25,600 tons the previous year, costing £14,635, or 11s. 5·21d. per ton; being an increase of 1785 tons and £2544 respectively. The gas made was 349,180,000 cubic feet, as against 325,443,000; being an increase of 23,737,000 cubic feet, or 7 3 per cent. This constitutes a record for the department. The gas made per ton of coal carbonized was 12,751 cubic feet, as against 12,712 cubic feet, being an increase of 39 feet per ton. The quantity of gas sold was 307,853,000 cubic feet, as against 285,288,000 cubic feet; being an increase of 22,565,000 cubic feet, or 7·91 per cent. The unaccounted-for gas was 38,421,000 cubic feet, or 10·95 per cent. of the make, as against 36,107,000 cubic feet, or 11·06 per cent., a decrease of 0·11 per cent. The works and plant were maintained in good repair and thorough working order out of the year's revenue. The prices of residuals had been lower during the year; but a larger tonnage had been sold, and had realized £748 more than in the preceding year. The gas for public lighting in the borough, including wages and maintenance of lamps, amounted to £4784, as against £4509, an increase of £275. The cost of gas for public lighting amounted to £2476, as against £2335, an increase of £141. This increase was due to the erection of more lamps in the borough and a return to the normal lighting hours.

The balance in the bank on March 31 was £3518, as against £590 owing to the bank twelve months ago. A sum of £2915 had been allowed for depreciation, as against £2643. The amount of gross profit made was £16,334, as against £16,289; being an increase of £45. This was despite the fact that £2543 extra was paid for coal during the year, and that there was an increased cost of materials and wages. The net profit, after allowing for interest, redemption instalments, and contribution to sinking fund, amounted to £6746, as against £6694, an increase of £52. If the gas for public lighting (£2476) was again given by the department, as in former years, there would remain an available surplus profit of £4270, as against £4359 for the previous year.

BURTON GAS AND ELECTRICITY UNDERTAKINGS.

The Past Year's Working.

At the Meeting of the Burton-upon-Trent Town Council last Wednesday, the report of the Gas and Electricity Committee on the working of the two undertakings controlled by them in the year ended the 31st of March last was presented.

The revenue from the supply of gas was £65,936, and the working expenses were £51,815; showing a gross profit of £14,121. After meeting loan charges and other items, including nearly £4000 for new meters, stoves, &c., the net profit for the year was £6263, against £13,497 for the preceding twelve months; and the surplus has been applied in relief of the rates. The Committee explain that the reduction of more than £7000 on the net profit is practically all accounted for by the substantial reductions made in the price of gas, the higher cost of coal, and increased working expenses. Two reductions in price were made in the course of the preceding financial year; and the consumers benefited by them to the extent of £3152—the ordinary class to the amount of £1971 and the prepayment class by £1181. The total quantity of gas sold was 411,370,500 cubic feet—an increase of 7·29 per

cent.; while the total accounted for was 414,953,800 cubic feet, or 7·31 per cent. more than before. The coal carbonized was 39,610 tons; and the make of gas per ton was 11,005 cubic feet, of which 10,386 cubic feet were sold. The quantities of saleable residuals were: Coke and breeze, 19,591 tons; tar, 379,019 gallons; and ammoniacal liquor, 900 tons. The ordinary income from the electricity works was £17,054; while the expenditure was £8103—the gross profit being £8951. After meeting the loan charges and other items, the surplus was £3055, of which £1000 went to the relief of the rates and £2055 to the renewals funds. The surplus was £1866 more than for the preceding year.

Mr. G. TARVER, the Vice-Chairman of the Committee, in the absence, through indisposition, of the Chairman (Alderman Lowe), moved the adoption of the report. In the course of his remarks he said the increased output of gas to the extent of about 7 per cent. might be considered very remarkable, when the extremely mild weather of April last year was taken into consideration. It compared well with the previous increase of 5¼ per cent. The total number of consumers was 11,566, an increase of 609; and there were 6042 stoves and 709 gas-fires, or respectively 808 and 567 more than before. There was a very considerable drop in the profits—no less a sum than £7235. The whole of the decrease was not very difficult to account for, when they considered the concessions made by the reductions in price during the last few years. As a matter of fact, in every one of the last four years they had lowered the price of gas, until it was now 2s. per 1000 cubic feet. The decision to reduce the price was prompted by the fact that the Committee confidently expected no advance in the price of coal. They quite thought that the coal for which they had been paying 2s. 6d. a ton more than in 1911 would not again be raised in price; but it was put up 1s., and therefore cost 3s. 6d. per ton more than 1911, or a total for the year of more than £3000 increase. This was one of the main reasons why the profits were so much reduced. The reduction was also one to lower sales and prices for coke and ammoniacal liquor. There was an additional expenditure of £8392 during the year—£1300 being represented by higher wages, and £3348 in respect of the increased price of coal.

Mr. KING seconded the motion.

Mr. HUTCHINSON thought that the Committee had no reason to be ashamed of their balance-sheet, and he considered that in the gas-works the town had a very valuable asset.

Alderman ROWLAND congratulated Mr. Tarver upon the report he had presented. Referring to some comparative figures in it showing the progress of the gas undertaking in the past ten years, he pointed out that if the consumers to-day were charged at the same rate as in 1904, the Committee's revenue would have been higher by £15,000. In addition, they had made an increased contribution to the relief of rates from £5000 to £7000. The £15,000 he had mentioned as being practically handed back to the ratepayers represented something like 1s. in the pound; and he had no hesitation in saying that the ratepayers generally were not paying one penny more for the upkeep of the town than they did ten years ago.

The report was adopted.

STREET LIGHTING SPECIFICATION.

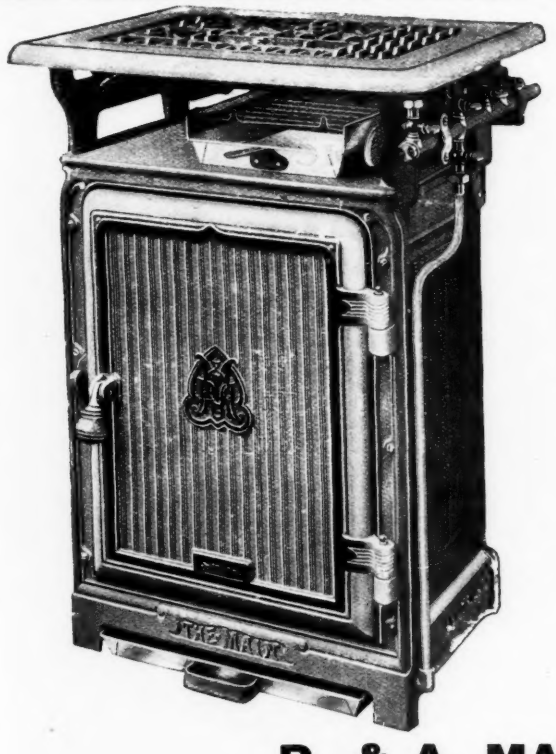
Electricians' Criticisms of Mr. Jacques Abady's Suggested Clauses.

In last week's issue of the "JOURNAL," p. 420, there was reproduced from the "Electrician" an article by Mr. Jacques Abady, dealing with the subject of street lighting in relation to the standard specification proposed by the Joint Committee of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of Municipal and County Engineers, and the Illuminating Engineering Society. Three prominent electricians discuss the article in the current issue of our contemporary; and from their letters we purpose giving a few extracts.

Mr. KENELM EDGCUMBE remarks, with satisfaction, that Mr. Abady is, apparently, a convert to the appraising of street lighting on the basis of illumination; but, at the same time, he differs from the majority of the Joint Committee in selecting a surface normal to the rays of light, rather than a horizontal plane. Mr. Edgcumbe claims that Mr. Abady has now largely come round to his way of thinking, by the abandonment of the clause insisting on horizontal reflectors, and by his insisting on a greater candle power at 20° than at 50°. His only complaint in this connection is that 15 per cent. is not nearly enough.

Mr. Edgcumbe continues: Mr. Abady's proposed clause 4, dealing with photometers, does not appear to be at all clear. In the first place, "horizontal readings" are alluded to, whereas I had always understood that these latter were anathema to Mr. Abady. Again, a height ranging from 3 ft. to 4 ft. 6 in. is allowed for the horizontal screen; but this is surely too great a variation. The clause further lays down that "the photometer used shall be one working on the law of inverse squares." What this means is not obvious. If it is that, in calculating the candle-power of the lamp under test the law of inverse squares is to be assumed, this part of the clause would seem to be redundant. Or, on the other hand, is the intention that the adjustment of illumination on the internal screen of the photometer shall be carried out by moving the lamp, on the assumption that the illumination will be inversely proportional to the distance of the internal service from that lamp? I would point out that this method of construction, like that of fitting electrical measuring instruments with "predetermined" scales, has now been abandoned by all the best makers, who, without exception, calibrate their instruments empirically. It certainly seems a retrograde step to assume any "law," and above all one which can never be more than approximately correct in such an apparatus as a portable photometer.

In conclusion, he says that Mr. Abady has advanced so far in the direction outlined by the Joint Committee, and has added so many excellent clauses of his own, that Mr. Edgcumbe feels confident the few remaining "peccant paragraphs" on both sides will not be difficult of adjustment under the skilful touch of Mr. Trotter.



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Mr. LANCELOT W. WILD approves generally of Mr. Abady's specification; but there are three points he thinks call for criticism.

With regard to the statement that 96-candle power on 10-feet posts produces the same minimum illumination as 44-candle power on 20-feet posts, both being 100 feet apart, Mr. Abady states that the former would produce the better lighting. Mr. Wild differs. The seeing value of the light would, the latter thinks, be better with the smaller candle-power on the higher posts, owing to the reduction of glare.

In clause 9, sub-clause (4), it is specified that the photometer shall be one working on the law of inverse squares. Mr. Wild employs such a description of photometer, and prefers it to others at present on the market. Nevertheless, he thinks that it is a mistake to specify the tool that the workman should use. Provided that the photometer can be proved to be reasonably accurate, this should be sufficient. It is most undesirable for progress to be stopped by any attempt to standardize the tool.

Mr. Wild agrees with Mr. Abady that, in the present state of the art, measurements of candle-power at stated angles are more practicable than measurements of illumination; but he thinks that Mr. Abady's angles are altogether wrong—the angles for test should be dependent upon the height of posts and spacing, and in some cases the known light distribution curve of the source might also modify the angles selected.

As a rule, the candle-power at 50° is of very little value. Mr. Wild suggests that in most cases candle-power measurements be made at 15° and 30°; twice the significance being given to the former as the latter. Thus, multiply the reading at 15 by 2 and that at 30 by 1, add the two together, and divide by 3. Something on these lines would secure adequate value being given to the rays which illuminate the far-distance.

Mr. HAYDN HARRISON agrees with much of the earlier part of the Abady specification, but disagrees with him on clause No. 9.

Mr. Harrison continues: Mr. Abady appears to be under the impression that the proposed basis of minimum horizontal illumination suggested by the Joint Committee was severely criticized. This is true to the extent that it was severely criticized by himself and one or two others; but by the large majority it was accepted as the only solution. He further states that it "curiously enough was unfavourably received by the gas interest, although what it would have obviously penalized was metal filament lighting." As a member of the Committee, I do not remember any very unfavourable reception by the gas interest represented on the Committee, and personally cannot see that it favoured either gas, metal filament, or any other form of lighting. Moreover, Mr. Abady must be a little out-of-date if he thinks that the electric lamp of the future (say, the nitrogen filled lamp) will have the same characteristics as the metal filament electric lamp of to-day, any more than the upright incandescent gas-mantle of yesterday embodies the same characteristics as the inverted mantle of to-day. And I am certain that anybody who has studied the deliberations of the Committee will support me in the statement that they did not specially consider gas, electric light, or any other particular illuminant, but that they were endeavouring to provide a specification which would be equally applicable now or in the future—bearing in mind the many sources of light which are likely to develop, that are at the present moment unknown.

Mr. Abady's article is interesting inasmuch as it attempts to answer a question which has been put to me on many occasions—namely, why the angles of 20° and 50° from the horizontal are chosen for testing purposes. It is obvious from his article that he knows there is every reason for surprise at these angles being chosen. He states that "these are selected because they give a good idea of the ratio between the 'near' and 'distant' lighting, and because their mean will afford a rough approximation of the mean hemispherical intensity."

The first of these reasons is an obvious fallacy. For example, take the angle of 20° (or "distant" angle) with a lighting source 11 feet high, it only covers a distance of 30 feet, and, of course, the "near" angle of 50°, which in this case would be 9 feet from the lighting source, is obviously a matter of no importance. I would ask Mr. Abady how this method of specifying would assist the illumination of the other 60 feet of the road and pavement existing between light sources usually 120 feet apart. He may answer that 11 feet is too low to consider; but he has already cut the ground from under his feet as regards this answer by attempting to prove, by his reference to the table attached to the suggested specification, that the raising of the height of an illuminant does not improve the conditions of street lighting.

With regard to Mr. Abady's second reason for suggesting such angles—viz., that their mean will afford a rough approximation to the mean hemispherical intensity—I think he will admit without question that the mean hemispherical intensity of a lamp used for street lighting has little to do with its efficiency for the purpose. For example, suppose the maximum intensity was vertical and the minimum horizontal, the mean hemispherical might still be excellent, but the efficiency of such a lamp for street-lighting purposes would be very low. Therefore, why should we attempt to use angles because they give an approximation of mean hemispherical intensity, which factor is of no importance?

I would suggest, therefore, that there can be no good reason for boosting-up these suggestions as regards measurement because they happen to exist in a specification which was drafted some considerable time before the Joint Committee published the result of their deliberations. It must be remembered that this Committee consisted of members drawn from the Illuminating Engineering Society, the Municipal Engineers, the Institution of Electrical Engineers, and the Gas Institution; and it would be as well to note that the adverse criticism on this specification which emanated from America and the Continent did not include suggestions that candle-power should be measured at angles of 20° and 50°.

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FIRES IN THE CITY OF LONDON LAST YEAR.

Some of the Causes.

In the annual report of the City Coroner (Dr. Waldo) for the past year a summary of the causes of fires in the City, as established after full inquiry, is given in the form of an appendix, from which it is seen that, of the 158 fires reported, in 136 cases the cause was determined, and in only 22 does it still remain unknown. The Coroner states: "In the case of 16 fires I have, with the expert assistance of the Electrical Engineer, been able to decide that these fires were due to defective electrical arrangements. In the course of my fire inquiries, many suggestions have been made and adopted by owners and occupiers with a view to the saving of life and property in the future. The past year is again remarkable for the small number of serious fires occurring within the boundaries of the City. So favourable a result may, I think, be fairly attributed, in no small part, to the working of the City Fire Inquests Act."

The summary attached to the report shows that of the 158 fires reported, two were caused by blinds or curtains coming in contact with light; one was the result of paper decorations in contact with a gas-pipe; sixteen were due to electric circuit or defective arrangements; four were caused by gas-rings; eight by ignited escaped gas; two through the over-heating of gas-stoves; two by mineral-oil lamps; and a like number by the ignition of petrol or spirit vapour.

THE BLACKBURN GAS STRIKE.

This question (says our Manchester correspondent) is still a subject of absorbing interest in the East Lancashire district; but it is generally hoped that, as the result of a prolonged conference between Mr. J. R. Clynes, M.P., the Lancashire District Secretary of the National Union of Gas Workers and General Labourers, and Mr. Councillor E. Porter (the local Secretary) and a deputation from the Blackburn Corporation, regarding an alleged breach of the agreement entered into on the settlement of the recent strike, that all outstanding difficulties will be overcome and a second strike obviated. The complaint against the Corporation had reference to the reinstatement of the strikers; and this matter was discussed by Mr. Clynes with the Mayor (Alderman J. Higginson) and the heads of the Corporation departments for more than two hours on Monday of last week.

Subsequently there was a mass meeting of men in the Overlookers' Hall, at which Mr. Clynes stated that he did not hold the view that the Corporation had kept the bargain the men made with them that all the servants who came out on strike were to be immediately restarted, except such men as could be classed as "seasonal" workers, and who would not, at the time of the settlement, have been in the service of the Corporation had a strike never occurred. This interpretation had never been questioned, and in his evening interview with the Mayor, he (Mr. Clynes) had said definitely that he would have made no settlement had he thought the fifty or sixty of their fellow-workers were being kept out of employment after the rest had resumed work. Mr. Clynes also touched on the question of the cost of the strike, and remarked that the loss of £12,000 which the public of Blackburn had to pay would have covered the whole of the outstanding claims of the men at the time of the strike for a period of more than ten years. The Union, he added, would continue to support the men who had not been reinstated; and he hoped as a result of the present interview there would not be one case respecting which they would have to make further complaint to the Corporation.

STANDARDIZATION OF WATER-FITTINGS.

The Sixth Annual General Meeting of the Incorporated Joint Committee on Water Regulations was held in the Guildhall, London—Alderman HAMILTON in the chair.

The SECRETARY (Mr. W. R. E. Coles) read the report of the Executive Council, which furnished the following particulars. The year had been characterized by a very marked increase in the interest evinced by water authorities and architects, as well as by the manufacturers of water-fittings and others, in the objects which the Committee was originally formed and subsequently incorporated to promote. The Council had endeavoured to direct usefully the growth of this interest. A fresh draft model form of bye-laws had been prepared, embodying provisions additional to those appearing in the Committee's Model Code of 1912; and they might be now sanctioned by the Local Government Board, if so desired by water authorities. The Council had addressed a special communication to these authorities on the subject of water-fittings; and they expressed their pleasure in reporting that the Wolverhampton Corporation Water Committee had issued notices that fittings would not be approved for use in the water area unless bearing the Joint Committee's standard mark. The Standardization Committee had had under consideration the details of construction of some of the fittings included in the 1912 specification and the amplification of them made last year, and had decided to recommend certain alternatives which were set out in the report. The Council were pleased to record that Mr. W. D. Caröe, the Architect to the Ecclesiastical Commissioners, and a member of the Council, found continued reason to be satisfied with the practice of requiring that plumbers' work carried out in buildings under his direction should have the standard mark used by regular plumbers, and that the water-fittings should be those complying with the specifications of the Joint Committee and bearing their mark. The Council felt that this practice deserved the attention of water authorities and architects, as well

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as of property owners and others, as tending to secure better and more reliable plumbers' work and water-fittings.

The CHAIRMAN, in moving the adoption of the report, said the meeting would, he thought, see that it was of a satisfactory nature. With regard to the paragraph respecting bye-laws, he might say they had had some experience with regard to this in Preston. They promoted an "Omnibus" Bill, and when the Town Clerk saw the Agents they strongly recommended that some of the model bye-laws of the Local Government Board, dealing with powers for the prevention of waste, should be incorporated. They were adopted; and the Select Committee to whom the Bill was referred accepted them with very little evidence. The Wolverhampton Corporation had set an exceedingly good example in the action they had taken, as set forth in the report; and he wished all local authorities would do likewise. If architects would insist on the water-fittings being only those which complied with the specifications of the Joint Committee, they would soon find them universally adopted. Personally, he was extremely glad to see the suggested amplification of the specifications, as it might thereby be practicable to find what they all sought—viz., a superior standard of fittings introduced throughout the country.

The report was adopted; and the recommendations of the Standardization Committee with regard to the amplification of the specifications were agreed to.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Edinburgh Electric Lighting Committee are evidently concerned at the offer made by the Gas Commissioners to provide public lighting in the city with high-pressure gas at a price of £7 per lamp per annum. When it is understood that the price for electric lighting for the same period and number of hours is £9 per lamp, there is shown good reason for this concern. In consequence, the Electric Lighting Committee, on the motion of the Convener, Councillor Stevenson, have instructed their Engineer to report on the whole question of the cost of public lighting, also as to what would be the cost of lighting by electricity all the streets at present without the benefits (?) of electric light. Whether the Lighting Committee will see eye to eye with the Electrical Committee on the question of the entire substitution of the electricity for gas throughout the streets of Edinburgh is very doubtful. When the amount of light obtained from a high-pressure gas-lamp is compared from that of an arc lamp, the question of saving is still further emphasized. It is only to be expected that Edinburgh, as well as other towns, should follow the lead of London in the use of high-pressure gas where large spaces have to be illuminated.

Messrs. Fairweather, the Joint Managers of the Kilmarnock gas undertaking, have reported that they consider the oeffrs for the tar which they had received were unsatisfactory, and they are recommending a probable expenditure from £1100 to £1200 for the purpose of providing accommodation for storing the tar for the winter, after which it is expected that better prices will be obtainable. A Sub-Committee have had this matter under consideration, and offers have been obtained for the necessary storage vessels. In view of the large quantity of tar now being used for road surfacing purposes, which work can only be carried on in the spring and summer, the provision of storage for the winter months seems a very wise one, as to obtain the best price it is necessary for some one to keep the material until the demand arises, and it would appear to be in the best interests of the Gas Department that they should hold the stock until the market is open.

At the meeting of the Haddington Town Council this week, the Town Clerk submitted a letter in reply to a communication from the Board regarding the taking over of the gas undertaking. In the letter it is stated that the Company were not willing sellers, but that the Directors would be prepared to advise the shareholders to allow reasonable access to the plant and books by an approved expert, so that the Board might ascertain what was a reasonable sum for them to offer if they decided to take over the concern. As some of the details would necessarily have to be given to the expert in confidence, the Gas Company asked to be informed of the name of the expert engaged. The subject of appointing an expert will be discussed in private.

Among the list of Companies recently formed under the Company's Consolidation Act is that of the Oban and District Gas Company, with a capital of £10,000, in £1 shares. This is a private Company formed for the purpose of carrying on the business of a gas company, and in this connection to acquire the rights, property, &c., of Henry Ellison, Limited, in the above gas-works. The undertaking has been supplying about 8 million cubic feet of gas per annum, despite a high price of 7s. 6d. per 1000 cubic feet charged for it.

Dunfermline are to spend an estimated sum of £11,000 on their gas-works, and have accepted an offer for the construction of additional works and extension of buildings and plant. This has been rendered necessary owing to the expansion of Dunfermline, which is the nearest large town to the new Naval Base at Rosyth. Advantage has also been taken of the boosting system to supply outlying villages.

The Cowdenbeath Town Council have been discussing the question of the acquisition of the undertaking of the Cowdenbeath Gas Company.

The question of reconstruction or entirely new works has again been before the Kirkcaldy Town Council. There was considerable discussion, which was further complicated by the question of the new railway line along the foreshore for the conveyance of coal from the new pit of the Fife Coal Company to the harbour. The revenue to be derived by the Town Council from this shipment of coal in their harbour will be considerable—certainly much more than the inhabitants can hope to receive from possible visitors to the town through an improved foreshore and esplanade. Several councillors appear to have a brief for the vertical retort systems, and to have studied the figures of results

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obtained with them. They advocated an entire new works, even though it necessitated going outside the burgh boundaries. Bailie Wright, who has given so much attention to gas matters in the town, has already resigned the convenership of the Gas Committee, in view of the resolution carried at the former meeting of the Council, and Provost Lockhart has agreed to act as interim Convener. Finally, Treasurer Kilgour proposed that, in view of the statement regarding the railway line along the foreshore, no action be taken either for reconstruction or for the construction of new works until the railway question had been decided. On a vote, 20 were in favour of delay and 4 only for proceeding at once. The railway along the foreshore seems to be the solving of the question, as no doubt the Town Council can arrange for the carrying over these rails of all the coal required for the gas-works. A branch line can then be carried into the works by which all the coal can be received and coke carried away. Let Kirkcaldy stick to its manufactures and make the town a business centre, and leave the trippers to go to the neighbouring towns in Fife which have not the support of works and workers.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 18.

The London market for tar products remains in a very quiet state, which is usual at this season. Shipments, particularly of pitch, are practically completed. Since Easter enormous quantities of tar and pitch have been sent out for road purposes, and great activity in this work is assured so long as the weather is suitable. The only variation in prices to record is that pitch may be quoted as nominally 37s. net.

The sulphate of ammonia position is unduly depressed; and for May-June delivery sellers ask £11 5s., with buyers at about £11 net, in buyer's bags *ex* makers' works, for 25 per cent. quality.

Tar and Tar Products in the Provinces.

May 18.

The average values during the week were: Tar, 25s. 6d. to 29s. 6d. Pitch, east coast, 36s. to 36s. 6d.; west coast, Manchester, 35s. to 35s. 3d.; Liverpool, 36s. to 36s. 6d.; Clyde, 36s. to 36s. 3d. Benzol, 90 per cent., naked, North, 10¼d. to 10½d.; 50-90 per cent., naked, North, 10d. to 10½d. Toluol, naked, North, 10½d. to 11d. Crude naphtha, in bulk, North, 4¾d. to 5d. Solvent naphtha, naked, North, 9¼d. to 9½d. f.o.b. Heavy naphtha, naked, North, 9d. to 9¼d. f.o.b. Creosote, in bulk, North, 3⅛d. to 3⅜d. Heavy oils, in bulk, 3⅝d. to 4⅛d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 0½d. to 1s. 1d. Naphthalene, £4 10s. to £10; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, nominally, ¾d. per unit, packages included and delivered.

Sulphate of Ammonia Prices in the Provinces.

LIVERPOOL, *May* 16.

During the past week the tone of the market has remained very dull, and it has only been possible to dispose of the present output by accepting rapidly declining prices. Buyers for the most part are only interested in near delivery, and show little disposition to anticipate their future requirements. The closing quotations are £11 3s. 9d. per ton f.o.b. Hull, £11 5s. per ton f.o.b. Liverpool, and £11 7s. 6d. per ton f.o.b. Leith. In the forward position, little fresh business has been reported; but it has transpired that in the early part of the week some first-hand transactions were put through for July-December delivery at £11 10s. per ton f.o.b. at the ports.

Nitrate of Soda.

This market is again the turn easier, and the spot values to-day are 9s. 10½d. per cwt. for ordinary quality, and 10s. 1½d. for refined.

From another source it is reported that there has been a decided drop in sulphate of ammonia during the past week, and there appears to have been a rush to get rid of stocks. In fact, business has been done to the end of the year at very low prices. Outside London, makes to-day are quoted at £10 12s. 6d. to £10 15s.; Hull, £11 3s. 9d. to £11 5s.; Liverpool, £11 7s. 6d.; Leith, £11 10s. to £11 12s. 6d.; Middlesbrough, £11 5s. to £11 6s. 3d.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is quiet, and for some classes of coal the demand has shown a falling off, though the exports are tolerably full. In steam coal, best Northumbrians are from 13s. 8d. to 14s. per ton; second class steams are about 12s. 3d.; and steam smalls are rather quieter at 6s. 9d. to 7s. 9d. per ton f.o.b. The output is steady; and there are several large contracts in the market for steam coals. In the gas coal trade, the local consumption is lower; but the Baltic shipments are full at present. Best Durham gas coals are from 13s. 6d. per ton f.o.b.; second-class qualities about 12s. 8d. per ton; and "Wear specials" from 14s. per ton f.o.b. Among the contracts that are placed is that for Ghent—some 30,000 tons over twelve months. The price is said to be a little below the current values, but exact figures are not yet obtainable. Some sales of cargoes for Mediterranean ports are also announced, and the lower freights enable the delivered prices to be lower than they were. Buyers for forward delivery, whoever, look for further concessions; and from some quotations for coal at Genoa, it is evident that such concessions are being made, helped by the lower sea freights Coke is steady. Gas coke appears to be in lesser stocks—the production, of course, being lower; and the exports good of late. Gas coke is from 13s. 3d. to 13s. 9d. per ton f.o.b. in the Tyne.

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LEST YE FORGET.

Profit-Sharing at Burton-upon-Trent.

In the course of his remarks when moving the adoption of the report of the Gas and Electricity Committee at the meeting of the Burton-upon-Trent Corporation last Wednesday (noticed elsewhere), Mr. Tarver stated that, an application having been made to them from all grades of workmen for a further increase in wages, on the ground of the higher cost of living, the Committee had considered the question of introducing a system of profit-sharing. They accordingly asked their Consulting Engineer (Mr. J. Ferguson Bell, M.Inst.C.E.) to go into the matter and submit a report. Mr. Bell, as the result of his experience at Stafford years ago, reported favourably on the proposal; and the Committee then asked him and the Manager (Mr. R. S. Ramsden) to confer with the men on the subject. The men, however, would not consider profit-sharing without some increase in their wages; and the Committee were thus faced with the difficulty that they would have to make some small advance. They had already done so in the case of the fitters and lamplighters. The advance and profit-sharing would render it difficult for the Committee to keep down the expenditure as much as possible. The change would make a difference of £900 a year in wages; but the Committee had every reason to hope that the money paid would be more than recouped by the greater attention the men would give to their work, and the additional interest they would feel in it In response to a question, Mr. Tarver explained that the delegated powers of the Committee enabled them to put the scheme into force without consulting the Council. As, however, they had adopted the system, they thought they would not like to bring it into operation before they informed the Council what they were doing. They now knew that a profit-sharing scheme was in operation at both the gas and electricity works.

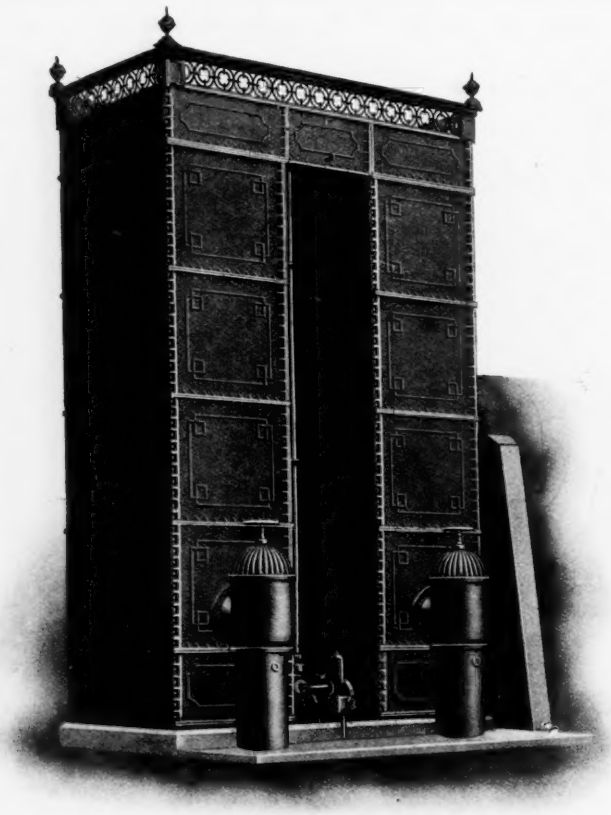
Gas Profits at St. Helens.—The Gas Committee of the St. Helens Corporation have voted a sum of £3000 from their profits for the relief of the rates. The total profits for the past financial year were £5550, against £8700 before; but the decrease is fully explained by the fact that coal cost nearly £4000 more, while during the whole of the year the public lamps were supplied with gas at cost price, and the charge for domestic purposes was reduced by 2d. per 1000 cubic feet. The price is now 2s , with discount and free use of stoves and meters.

Middleton Gas-Works Statistics.—At the last monthly meeting of the Middleton Town Council, Mr. Hilton, in moving the adoption of the minutes of the Gas Committee, said the make of gas for the year ended March 31 last showed an increase of 3,110,000 cubic feet, or 2·16 per cent., over the previous year. The gas profits for the twelve months amounted to £546; those for the previous year having been £2491. But against this they had reduced the price of gas 2d. per 1000 cubic feet, which represented £1150. The extra cost of coal was £976; and the decrease in the amount received from the sale of coke was £500.

South Barracas Gas Company.

The Directors' report submitted at the meeting in London last Thursday of the South Barracas (Buenos Ayres) Gas and Coke Company, Limited, stated that, on the operations for the year ended Dec. 31 there was an available balance of £5287 (after payment of an interim dividend of 2 per cent.). A final dividend of 2 per cent., making 4 per cent. for the year, free of income-tax, was recommended, which would leave a balance of £1287 to be carried forward. The balance of revenue account for the year, after charging £3797 interest on loan and advances, amounted to £5336, against £3567 for 1912, and £1168 for 1911. The output of gas in 1913 again showed an increase over the previous increase in 1912—being nearly 4½ million cubic feet for the year. Receipts from residuals also showed an increase of £1312. The works, plant, mains, and all other apparatus had been kept up in a high state of efficiency out of revenue. During the year nearly 4 miles of mains were laid, making a total length of 116 miles. The contract for the public lighting by gas of the city of Lomas was giving every satisfaction. The erection of the additional four beds of retorts necessitated by the increases in gas output was being rapidly pushed forward, and as soon as completed would be of service in reducing the cost of manufacture, as the carburetted water-gas plant would then be shut down, except as a reserve against accidents or strikes. At the close of the period under review, the accounts showed a sum of £50,000 due to the bank, secured by mortgage debentures. In addition, further advances had been made in order to provide for extensions in mains and services and the erection of retorts. This brought the present indebtedness to £79,300, which represented expenditure on the Company's undertaking since 1910. It was proposed shortly to make an issue of £100,000 of either debenture stock or preference shares in order to repay these advances and for the general purposes of the Company.

Gas Profits at Congleton.—The net profit on the gas undertaking of the Congleton Corporation for the year ended the 31st of March last was £1275, compared with £1379 in the preceding year. The cost of coal, was, however, £455 higher, and £1000 more than in the year 1911-12. There was an increase of 2,800,000 cubic feet, or 4·43 per cent., in the make of gas. These figures came before the Gas Committee, in a report prepared by the Borough Treasurer, at the monthly meeting on Monday last week. The Mayor (Alderman J. T. Lucas), who presided, said the results at the gas-works were most satisfactory, when they considered the high price of fuel and the advance made in the wages of the men. He was sure the year's working would give great satisfaction, not only to the members, but to the town generally. It showed that the gas-works was very ably managed, and that they were in a good financial position. Alderman Barlow and Mr. Cartlidge said the results were very creditable to the Gas Manager (Mr. J. T. Broughton), who, on behalf of the staff and himself, expressed his thanks for the kind remarks made.



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Lurgan Lighting Scheme.—Mr. F. W. Pollock, the Town Clerk of Lurgan, has been notified that the Board of Trade have granted the Provisional Order, sanctioning the Urban District Council's proposed electric lighting scheme. The proceedings at the local inquiry into the Council's application were reported in the "JOURNAL" for April 14 and 21 [pp. 133, 199.]

More Money for the Stalybridge Gas-Works.—The Gas Committee of the Stalybridge Corporation have resolved that the Finance Committee should be recommended to exercise further borrowing powers on gas-works account, to the extent of £5000, in respect to the automatic stoking machinery, and that the amount should be repaid within a period of twenty years. The Finance Committee subsequently passed a resolution to the effect stated.

The New Vertical-Retort Installation for Bradford.—Among the estimates adopted by the Bradford City Council at their meeting last Tuesday was the recommendation of the Gas Committee that the tender should be accepted of the Woodall-Duckham Company for the erection at the Birkshall Gas-Works of a complete installation of vertical retorts capable of carbonizing 420 tons of coal per day, together with retort-house, coal and coke conveyors, bunkers, and screening plant, for £68,755.

Omagh Gas Undertaking.—At a meeting of the Omagh (co. Tyrone) Urban District Council, Messrs. Brandon and Co., the Auditors, reported that the working of the gas undertaking for the financial year ended in March showed a profit of £1506, as compared with £1612 for the previous year. They considered this satisfactory, in view of the increased cost of coal. But for this, the year's trading would have been the most satisfactory during the Council's ownership of the works, and far in excess of any results under the original Company's management. They paid a high tribute to the services of the Gas Manager (Mr. P. J. O'Callaghan), and recommended that he be granted a bonus for his efficient and economical management. The report was adopted.

Skegness Gas-Workers and Trade Unionism.—In their endeavour to get all gas-workers within the trade union ranks, those responsible for the propaganda in connection with the National Union have been particularly busy recently in the North Midland district. Skegness, Lincolnshire's popular seaside resort, has been the latest centre singled out for attack; and at a recent meeting held there Mr. Arthur Hayday, of Nottingham, the District Secretary, who had gone over to whip-up enthusiasm in the cause, made reference to an allegation that the local gas-workers had been threatened with dismissal if they joined the Union. He declared that bigger men than Skegness had ever seen had attempted to impede their progress, but had failed; and he urged that the only security for the employees was to join the Union. Nobody had heard of any such threat locally until Mr. Hayday gave it currency; and the first attempt of the meeting to influence the Skegness authorities has fallen curiously flat—the Urban District Council last Tuesday ignoring the demand for the establishment of a minimum wage of 5½d. per hour, considering their workmen to be already fairly paid.

Bury and District Water Board.—The total expenditure of the Board for the past year was £77,369, against £75,885 in the previous year. The Board now pay £10,500 a year in rates and taxes; in other words, of every £1 drawn from water consumers 3s. goes in this way. The income for the year was £66,152, against £64,000; and the loss was £11,217, against £11,883. It is estimated that £77,450 will be spent during this year, and that £66,550 will be received.

Cape Town and District Gas Company.—The report to be submitted at the annual meeting of the Company to-morrow states that the result of the working for the year ended Dec. 31 is a profit of £17,001, which, with the sum of £2414 brought forward, makes a total of £19,415 to the credit of profit and loss account. Out of this, debenture and debenture stock interest paid and accrued to the end of 1913 has been provided. The sum of £423 has been written-off for depreciation of stocks on hand, and the sum of £6000 has been written-off the new retort installation, leaving a balance of £3918, out of which the Directors propose to pay a half-year's dividend—namely, £2250—on the preference shares, and to carry forward £1668. There was a decrease of 84 in the number of consumers; but the sales of gas were larger, chiefly owing to the increased demand for manufacturing and industrial purposes. On an average, coal cost 4s. 6½d. per ton more than in the previous year. Serious labour troubles in Cape Colony caused extreme anxiety and difficulty; but the Company were able to continue regular working.

Electric Lighting at Dundalk Opposed by the Gas Company.—At an inquiry last Tuesday at Dundalk by Mr. P. C. Cowan, the Chief Engineering Inspector of the Irish Local Government Board, Mr. R. Best, K.C., on behalf of the Dundalk Gas Company, appeared to oppose the Urban Council's application for a loan of £20,000 for extensions of electric lighting undertaking with a view to supplying the Great Northern Railway Company of Ireland at their locomotive works—the supply being proposed to be at the rate of 0·9d. per unit for 480,000 units and 0·7d. for any excess over this amount. The Company agreed to pay to the Council a minimum yearly rent of £1800. The Town Clerk was examined as to the liability of the Council for existing loans; and in reply to Mr. Best, he admitted that a sum of £800 had been paid over to the electric lighting undertaking for general expenses, and that this sum had not been repaid, nor was it estimated for as capital. The Electrical Engineer said that for the first ten months the working expenditure for the electric lighting of Dundalk was £1267, and the income £1454; and, allowing for loan charges, they would have a loss on this period of £163. Had the £800 referred to been charged to capital, the loss in the second year would, he said, have been a few hundred pounds. Mr. Best submitted that the scheme before the Inspector was unsound, as the Belfast Corporation could not supply electricity for their tramways at the price offered in the case of the Dundalk Council to the Great Northern Railway Company, and the output in Belfast was much larger. The Inspector will report the evidence and the arguments in due course.

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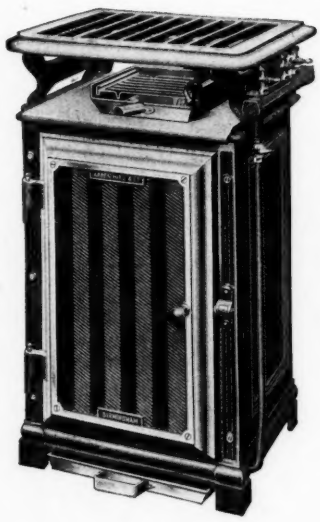

COMBINE ALL THE LATEST IMPROVEMENTS,
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Ipswich Water Supply.—At the meeting of the Ipswich Town Council last Wednesday, Mr. R. G. Bennett presented the accounts of the Water Department of the Corporation for the past financial year. They showed a net profit of £1903—an increase on the previous year, and a close approximation to the amount which it was proposed to hand over in relief of the rates.

Fylde Water Board.—The annual financial statement of the Board shows an income for the year ended March 31 of £72,993, as compared with £71,242 for the previous year. The total expenditure was £16,821, against £16,054. A balance of £56,172 is carried to the net revenue account, which, with interest and the balance brought forward, is raised to £104,329.

Hindley Gas and Water Profits.—At the monthly meeting of the Hindley District Council on the 12th inst., the Chairman of the Gas, Water, and Fire Committee officially announced that for the past year the net profits on the Council's gas undertaking amounted to £419 2s. 2d.; while the net profits on the water undertaking for the same period amounted to £72 18s. 10d.

Llandilo Gaslight Company.—A Company with this title has been registered, having a capital of £3000 in £5 shares, to take over works and manufacturing premises belonging to the Llandilo Gas Company, Limited, at Ffairfach, Carmarthen. The purchase consideration is £900, payable as to £750 to the Liquidator of the old Company, and as to £150 to the original purchaser and vendor to the Company.

Carlow Gas Company.—The statement of accounts for the year ended March last (which was adopted at the meeting of the Company last Friday) showed that the reserve fund or investments, at present market value, were £300 in excess of the paid-up capital of the Company, which was £5210; and, further, that the net profit for the year was £1008, or just equivalent to 20 per cent. A dividend of 8 per cent., free of income-tax, was declared.

Warrington Corporation Water Undertaking.—The statement of accounts of the Warrington Corporation Water Department shows a gross income of £33,029 for the twelve months ended March 31, against £31,062 last year. The expenditure totalled £11,178, compared with £9352; the increase being largely due to the heavier cost of fuel and to extensions which have been charged against revenue. The gross profit was £21,852, against £21,710; and the contribution to the sinking fund amounted to £19,839, against £19,555. Out of the net profit of £2012, compared with £2155 before, £500 has been allocated to the relief of the rates, and £1512 carried to the reserve fund.

Rumoured Dissolution of the Gas-Strip Association.—Last Friday's "Birmingham Post," in the course of their iron market report of the previous day, said: The chief interest of the day attached to the rumours in circulation that a decision had been come to to dissolve the Gas-Strip Association. The Association has not in late years been very seriously regarded by the market. Founded some fourteen years ago, it consists of about eighteen firms, and there are another half-dozen outside. The trade has lately been subject to foreign competition—large quantities of strip coming into the Midlands from Germany and Belgium; while the outside firms have been getting a large share of the business going for home manufacturers at quotations slightly under the Association price. Further, the market has sometimes suggested that the Association price has not always been a very rigid quantity. . . . During the recent depression members have been particularly hard hit by the competition, both home and foreign; and at yesterday's meeting it is understood the members discussed the best means of fighting it. The choice lay between meeting the competition as an Association, or removing all restrictions from members and allowing them individually to quote competitive prices without restraint. The latter course practically means the disbandment of the Association. In conversation, a member of the Association stated that the matter was in abeyance for a fortnight; but the market seems to have made up its mind that the Gas-Strip Association will soon be a matter of history.

APPLICATIONS FOR LETTERS PATENT.

10,861.—Yates, H. J., and Davy, J. F., "Gas-burners." May 2.
10,972.—Burgi, H., and Tenney, C. H., "Making gas." May 4.
11,000.—Edwards, A. N., "Inverted burners." May 4.
11,007.—Potter, W G., "Incandescent burners." May 5.
11,095.—Church, J., "Gas-furnaces." May 5.
11,136.—Climie, W., Jun., "Purifying gas." May 6.
11,150.—Drysdale and Co., Ltd., and Gauldie, K., "Compressing gases." May 6.
11,166-7.—Hardy, E. J., and E. J. Hardy and Co., Ltd., "Universal joints." May 6.
11,170.—Grant, J. C., "Controlling gas-burner flames." May 6.
11,177.—Hirst, H. T., "Burners for stoves." May 6.
11,178.—Toogood, H. J., and Robert Dempster and Sons, Ltd., "Vertical gas retorts." May 6.
11,236.—Haber, F., and Leiser, R., "Determining composition of gases." May 6.
11,239.—Selas Company, Limited, and Turner, E., "Gaseous-fuel burners." May 6.
11,246.—Smith, H. F., "Purification of gas." May 6.
11,247.—Smith, H. F., "Gas-producers." May 6.
11,262.—Bilham, C. S., "Pressure-reducing valve." May 7.
11,272.—Brooke, T., "Coal-stops for vertical retorts." May 7.
11,344.—Donnelly, S. H., "Water-mains" May 8.
11,348.—Palmer, F. H., "Controlling the flow of fluids." May 8.
11,359.—Simmance, J. F., "Calorimeters," May 8.
11,375.—Moeller, J., "Production of hydrocarbons." May 8.
11,387.—Railing, M. J., and Green, H. N., "Photometer." May 8.
11,391.—Clarkson, T., "Treatment of fuel." May 8.
11,401.—Loziano, L., "Control of valves." May 8.
11,420.—Porges, P., Stransky, S., and Strache, H., "Converting heavy hydrocarbons into light hydrocarbons." May 8.
11,523.—Noonan, J. H., "Gas-cooker." May 9.

PARKINSON'S
NEW BOOKLETS

British Coalite Company.—It is announced that the negotiations with the Yorkshire Colliery Company for the erection of a coalite plant, referred to by the Chairman at the last general meeting, are nearly completed. Other important proposals are occupying the attention of the Board.

Devonport Gas and Water Profits.—Alderman Tozer (Chairman of the Devonport Gas Committee) stated at a meeting of the Town Council last Thursday that the net profit of the gas undertaking for the last financial year was £2710. He was not in a position to place before the Council the full financial statement. A complaint had been received from the Labour Party as to the quality of the gas. Daily tests were made, and the illuminating power was above the required standard. The Mayor (Alderman Blackall), referring to the waterworks, said the net profit of the year was £996. This sum had been carried to the reserve fund.

St. Mary Church Gas-Works.—It was reported at the last meeting of the Torquay Town Council that the net profit of the St. Mary Church Gas-Works for the year ended March 31 was £1153, as compared with £1077 in the preceding year. Although the increase was not large, the Committee felt that, with the economies which had been suggested and were exercised by the Manager (Mr. F. Chalmers), the revenue account would still be more satisfactory, and help to provide a working balance the absence of which at times occasioned financial difficulty. Alderman Adams remarked that the gas-works had done very well, considering the great advance in the price of coal.

Extensions at Nelson.—The Nelson Town Council have approved a recommendation of the Gas Committee that application be made to the Local Government Board for sanction to borrow £6000 for mains and £6000 for meters, &c., required during the ensuing three years; and also £1250 for a new sulphate of ammonia plant.

Horses Asphyxiated by Gas at Royton.—Three horses owned by a Royton coal dealer were asphyxiated by gas last Thursday. Five horses were left overnight in a stable where there is a gas-engine, and it is surmised that during the night one of them got loose, and kicked the meter or the piping in such a way as to puncture it, allowing the gas to escape. The two surviving horses were led into the open air, where they gradually recovered.

Meters Limited.—In the report which will be submitted to the shareholders at the seventeenth ordinary meeting on Friday, the Directors state that the trading for the year ended March 31 has resulted in a gross profit of £35,282. After providing for interest on debenture stock and other charges, there is a net profit of £26,361, which, with the £2464 brought forward, makes £28,825, out of which interim dividends at the rate of 5½ per cent. per annum upon the preference shares and 4 per cent. per annum upon the ordinary shares have been paid. The Directors now recommend further dividends at the same rate upon the preference shares, and at the rate of 10 per cent. per annum (making 7 per cent. for the year) on the ordinary shares; and that £8000 be added to reserve (making the fund £100,000). This will leave £2828 to be carried forward.

GAS COMPANIES IN THE STOCK EXCHANGE.

The Stock Exchange has gone through an agitating week. Fortunately, it emerged unharmed, though badly scared. The trouble this time was owing to the speculative energy of an adventurous outsider who had "bitten off more than he could chew." The settlement of the fortnightly account thus became a prospective terror, and none could gauge the magnitude of the mischief if a crash were not averted. Happily assistance was rendered from powerful quarters, and the crisis was successfully tided over. But it gave things a nasty jar, from which it will take time to recover. In result, at the end of the week prices all round were better than they had started. On the opening day, business was quiet and rather dull for some time before a little improvement set in. Government issues remained weak, and Consols lost ¼. But Rails contrived to advance a little; and American closed firm. Foreign were hindered by Continental liquidation. Tuesday was quite cheerful, though business was very quiet, owing more to internal circumstances than any improvement in public affairs. Gilt-edged articles were firm, and Consols gained ⅜. All the other leading markets shared in the improvement. Wednesday brought a revulsion from this bright tone, and markets were shy and cautious, influenced by apprehension regarding the Ulster outlook. Consols did not move; but Rails were lower, and most of the rest were sluggish. Thursday was in happier vein—being now well assured that the settlement danger was over—and there was a fair amount of buying both for investment and for "bears'" cover. Government issues were firm, and Consols rose ⅛, while Rails improved. Transatlantics also did better; and the Foreign Market was steady. Friday breathed freely now the incubus was removed, and activity experienced some little fillip. Consols rose another ⅛, Rails rose, and Transatlantics were supported by Wall Street. Saturday was not so cheerful—too much selling on foreign account being at work. Prices in general were, therefore, lower. But Consols were unchanged, and closed at 74⅛ to 75⅛—a rise of ⅜ in the week. In the Money Market, the tendency varied considerably almost from day to day with no very strong movement either way. Business in the Gas Market was quieter than the week before, and presented no particular feature; and there was no change in quotations of any importance. In Gas Light and Coke issues, the ordinary was quite steady, and moderately active at the old figures; transactions ranging between 101¼ and 102⅛. In the secured issues, the maximum realized 77⅛ and 79, and the debenture 74⅞ and 75. South Metropolitan was quiet and unchanged at 109½ to 110½. In Commercials, the 4 per cent. changed hands at 106½ and 107½, and the debenture at 71⅞. Among the Suburban and Provincial group, Alliance and Dublin made 62, Bournemouth preference 13⅜, Ilford debenture 95 and 95½, South Suburban 115, Wimbledon 119⅛ to 120¼, and (on the local Exchange) Liverpool "B" 144. In the Continental companies, Imperial fetched 169 and 170½ *cum div.*, and 164 and 165½ *ex div.*, Union 82, ditto preference 120, and European 18⅛. Among the undertakings of the remoter world, Bombay marked 6½, Buenos Ayres 89¼, Primitiva 6 to 6 7/32, and ditto preference 5 1/32 to 5⅛.

OFFICIAL QUOTATIONS AT THE CLOSE OF THE WEEK.

Bank Rate (fixed January 29), 3 per cent. Last year, 4½ per cent. Consols, 74⅞—75⅛. Previous week, 74½—74¾.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	61—66	..	3 15 9
374,000	,,	Jan. 15	4	Do. 4 p.c. Deb.	78—81	..	4 18 9
280,000	5	April 29	7½	Bombay, Ltd.	5¼—6⅜	..	5 17 8
50,000	10	Feb. 26	16	Bourne-mouth Gas & Water Co.	10 p.c.	..	29 - 30
352,500	10	,,	7		B 7 p.c.	..	4 13 4
75,000	10	,,	6		Pref. 6 p.c.	..	4 5 9
380,000	Stk.	Feb. 26	14	Brentford Consolidated	260—265	..	5 5 8
330,000	,,	,,	11	Do. New	204—209	..	5 5 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	..	4 10 1
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	207—212	..	5 3 9
244,200	,,	,,	8	Do. A Ord. Stk.	153—158	..	5 1 3
530,000	20	Mar. 26	12½	British	44—45	..	5 11 1
120,000	Stk.	Dec 30	4	Do. 4 p.c. Deb. Stk.	90—92	..	4 7 0
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	89—91	..	4 7 11
100,000	10	—	—	Cape Town & Dis., Ltd.	1⅛—2⅛	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5—7	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	73—78	..	5 15 5
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	105½—108½	..	4 12 2
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	..	5 1 2
560,000	,,	,,	5¼	Do. 3½ p.c. do.	103½—105½	..	5 1 1
475,000	,,	Dec. 11	3	Do. 3 p.c. Deb. Stk.	71—73	..	4 2 2
800,000	Stk.	,,	4½	Continental Union, Ltd.	80—83	..	5 8 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	117—122	..	5 14 9
492,270	Stk.	,,	6	Derby Con. Stk.	123—125	..	4 16 0
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11
1,002,180	10	Jan. 15	10	European, Ltd.	18—18½	..	5 8 1
16,386,660	Stk.	Feb. 12	4/17/4	Gas Light and Coke	4 p.c. Ord.	..	4 14 7
2,600,000	,,	,,	3½		3½ p.c. max.	..	4 8 7
4,062,235	,,	,,	4		4 p.c. Con. Pref.	..	4 0 10
4,674,850	,,	Dec. 11	3	Coke	3 p.c. Con. Deb.	73½—75½	3 19 6
258,740	Stk.	Mar. 12	6	Hastings & St. L. 3½ p.c.		87—89	5 12 4
70,000	10	April 29	11	Hongkong & China, Ltd.		16¼—16½	6 11 4
131,000	Stk.	Mar. 12	7⅜	Ilford A and C		151—154	4 19 0
65,780	,,	,,	6⅜	Do. B		115—118	5 3 10
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.		94—94½	4 8 4
4,940,000	Stk.	May 14	9	Imperial Continental		164—169*	5 6 6
1,235,000	Stk.	Feb. 12	3⅜	Do. 3½ p.c. Deb. Red.		84—86	4 1 5
200,242	Stk.	Mar. 12	6⅓	Lea Bridge Ord. 5 p.c.		119—121	5 7 6
561,000	Stk.	Feb. 26	10	Liverpool United A		211—213	4 13 11
718,100	,,	,,	7	Do. B		143—145	4 16 7
306,083	,,	Dec. 30	4	Do. Deb. Stk.		99—101	3 19 3
63,480	Stk.	Dec. 30	3	Maidstone 3 p.c. Deb.		65—67	4 9 7
75,000	5	Dec. 11	6	Malta & Mediterranean Met. of Melbourne	4⅜—4⅝	..	6 3 1
250,000	100	April 1	4½		4½ p.c. Deb.	98—100	..	4 10 0
541,920	20	Nov. 27	4	Monte Video, Ltd.		11¼—12⅜	..	6 9 4
1,775,892	Stk.	Feb. 26	4½	Newc'tle&G'tesh'd Con.		99—100	..	4 10 0
529,705	Stk.	Dec. 30	P	Do. 3½ p.c. Deb.		83½—84½	..	4 2 10
55,940	10	Feb. 26	7/14 0	North Middlesex 7 p.c.		13½—14½	..	5 6 2
300 000	Stk.	May 14	8	Oriental, Ltd.		117—122*	+½	6 11 2
60,000	5	Mar. 26	10	Ottoman, Ltd.		7¼—7⅜	..	6 9 0
60,000	50	Feb. 26	13	Portsea, Island B		128—131	..	4 19 3
100,000	50	,,	12	Do. C		118—121	..	4 19 2
249,980	5	April 29	8	Primitiva Ord.		6—6⅛	..	6 3 1
499,960	5	Dec. 30	5	,, 5 p.c. Pref.		5—5⅛	..	4 15 3
521,600	100	Dec. 1	4	,, 4 p.c. Deb.		93—96	..	4 4 3
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.		87—89	..	4 9 11
150,000	10	May 14	6	San Paulo	6 p.c. Pref.	10½—11*	..	5 9 1
125,000	50	Jan. 2	5		5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mar. 12	10	Sheffield A		223—224	..	4 9 3
209,984	,,	,,	10	Do. B		223—224	..	4 9 3
523,500	,,	,,	10	Do. C		223—224	..	4 9 3
90,000	10	Oct. 15	7½	South African		11—12	..	6 5 0
6,429,695	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.		109—111	..	4 18 6
1,895,445	,,	Jan. 15	3	Do. 3 p.c. Deb.		73—75	..	4 0 0
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.		157—159	..	5 6 11
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.		114—116	..	5 3 5
60,000	,,	,,	5	Do. 5 p.c. Pref.		110—112	..	4 9 3
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.		113—115	..	4 6 11
629,740	Stk.	May 14	5	Southampton Ord.		99—102*	+½	4 18 0
120,000	Stk.	Feb. 12	7⅜	Tottenham District	A 5 p.c.	135—138	..	5 6 10
543,940	,,	,,	5⅜		B 3½ p.c.	115—117	..	5 0 5
149,470	,,	Dec. 30	4		4 p.c. Deb.	89—91	..	4 7 11
182,380	10	,,	5	Tuscan, Ltd.		5—6	..	8 6 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		95—97	..	5 3 1
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.		108½—110½	..	4 10 6
30,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.		151—156	..	5 7 4
255,636	,,	,,	6⅜	,, B 3½ p.c.		129—134	..	5 2 7
108,075	,,	,,	5/17/3	,, C 3½ p.c.		110—115	..	5 2 0
352,000	,,	,,	6⅜	Wimbledon 5 p.c.		117—122	..	5 0 5
98,000	,,	,,	6⅜	Epsom 5 p.c.		121—126	..	5 5 2
88,416	,,	Dec. 30	3	3 p.c. Deb. Stk.		71—73	..	4 2 2

Prices marked * are "Ex Div."

The Water Pollution Trouble at Kenilworth.—The General Purposes Committee of the Kenilworth District Council held a meeting last Thursday, and issued the following statement over the signature of the Vice-Chairman of the Council: "Mr. Hill, the Geological Expert to the Local Government Board, has this day visited the Kenilworth Water-Works, and assures us that the pollution of the new borehole is either due to surface water gaining access thereto, or (as is most probably the case) to unavoidable contamination during the sinking of the bore. Only subsequent analysis can determine which of these is actually the cause of the pollution. The Water Company's expert (Mr. H. Ashton Hill) assures us that he is satisfied that the new borehole has been adequately sealed, and hence there could be no pollution by surface water. In view of this, it will appear that the theory of contamination during boring operations is the correct one; and in course of time the new bore will yield a supply of a high standard of purity." It may be mentioned that the water from the new borehole is not now being used.

The May number of the "Bulletin" of the British Commercial Gas Association records that the gas undertakings at Ferndale, Glastonbury, Goulburn, Pontypool, Swansea, and Tenby have been added to the list of subscribers.

At a meeting of the Macclesfield Scientific Association, Mr. A. Merrick read an informative paper on "Vertical Retorts," the text of which was illustrated by lantern slides lent by West's Gas Improvement Company.

Owing, it is reported, to the fusing of electric light wires a serious fire occurred at the Government House, Auckland, N.Z., last Thursday, causing damage to the extent of several thousand pounds. The outbreak was discovered in a room occupied by General Sir Ian Hamilton, which was gutted; and other apartments were severely damaged.

An endeavour is being made by a London promoter of companies to provide capital for furnishing the northern portion of the County of Sussex with an acceptable supply of gas and water. It is contemplated that the North Sussex Gas and Water Company will be absorbed, and that extensions will be made to Slinfold on the one hand and Wisborough Green and Kidford on the other.

At the last meeting of the Crowle Urban District Council it was reported that, in reply to a request from the Council for a reduction in the price of gas for the next lighting season, the Crowle Gas Company had replied that, although the cost of production had increased during recent years, the Council could have the gas at 4s. 9d. per 1000 cubic feet—the price at present in vogue. The Council appointed a deputation to wait upon the Directors to discuss the matter.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER SUPERINTENDENT (Gas Plant). No. 5876.
SECRETARY AND MANAGER. Exmouth Gas Company. Applications by June 10.
TRAVELLERS. G. J. Eveson, 134, Edmund Street. Birmingham
FOREMAN MAIN AND SERVICE LAYER. Cleckheaton Urban District Council. Applications by May 23.
AGENT (Lighting Trade). No. 5873.

Appointments, &c., Wanted.

REPRESENTATIVE (New Zealand). No. 5878.
AGENCY IN GAS APPLIANCES. No. 5879.
SALES AND DISTRIBUTION DEPARTMENT. No. 5880.

Books Wanted.

J. ROBIN, Holywood Gas-Works, Belfast.

Plant, &c. (Second Hand), Wanted.

STATION METER. Old Silkstone Collieries, Dodworth.

Gas-Works Wanted.

"D. G.," c/o Scripps's Advertising Offices, 13, South Molton Street, W.

Patent, Licences, &c.

CARBIDE SUPPLY PISTONS FOR ACETYLENE GENERATORS, Haseltine, Lake, and Co., Southampton Buildings. Chancery Lane, W.C.
GASHOLDER. W. P. Thompson and Co., 6, Lord Street, Liverpool.
SPIRALLY-GUIDED GASHOLDER. W. Gadd, Park View, Richmnod Grove West, Manchester.

Sales of Stocks and Shares.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY. London Mart. May 26.
CANNOCK, &c., GAS COMPANY. By Tender. May 27.
FELIXSTOWE AND WALTON WATER COMPANY. London Mart. May 26.

Sales of Stocks and Shares (*continued*).

GRAYS AND TILBURY GAS COMPANY. London Mart. June 9.
HARROW AND STANMORE GAS COMPANY. London Mart. June 9.
LIMPSFIELD AND OXTED WATER COMPANY. London Mart. May 26.
RUGBY GAS COMPANY. Royal George Hotel, Rugby. June 5.
SOUTH ESSEX WATER COMPANY. London Mart. June 9.
SOUTHEND GAS COMPANY. London Mart. May 26.

TENDERS FOR

Bye-Products.

WARRINGTON GAS DEPARTMENT. Tenders by May 23.

Coal.

BANGOR (N.W.) GAS DEPARTMENT. Tenders by May 27.
BROADSTAIRS GAS COMPANY. Tenders by June 17.
CARLISLE GAS DEPARTMENT. Tenders by May 27.
DARLINGTON GAS DEPARTMENT. Tenders by May 22.
GLOUCESTER GASLIGHT COMPANY. Tenders by May 30.
LEEK GAS DEPARTMENT. Tenders by May 29.
LOUTH GASLIGHT COMPANY. Tenders by May 30.
SALFORD GAS DEPARTMENT. Tenders by May 28.
SEDGLEY URBAN DISTRICT COUNCIL. Tenders by June 4.
SHREWSBURY GAS COMPANY. Tenders by May 22.
SKIPTON URBAN DISTRICT COUNCIL. Tenders by May 30.
SWADLINCOTE GAS DEPARTMENT. Tenders by May 27.
TAUNTON GASLIGHT COMPANY. Tenders by June 1.
TORQUAY TOWN COUNCIL. Tenders by May 25.
WARRINGTON GAS DEPARTMENT. Tenders by May 23.
WESTON-SUPER-MARE GASLIGHT COMPANY. Tenders by June 1.

Cookers, Fires, &c.

WARRINGTON GAS DEPARTMENT. Tenders by May 23.

Fire Clay Goods.

WARRINGTON GAS DEPARTMENT. Tenders by May 23.

General Stores (Brass Goods, Taps, Cocks, Valves, Ironmongery, Castings, Bricks, Flexible Tube, Glass, Iron and Steel, Compo. Pipe, Oils and Paint, Drysaltery, Vitriol, &c., &c., Benzol).

SKIPTON URBAN DISTRICT COUNCIL. Tenders by May 30.
WARRINGTON GAS DEPARTMENT. Tenders by May 23.

Light Controllers.

BRIDGWATER GAS COMPANY.

Lighting Goods (Lamps, Fittings, Mantles, &c.).

CALCUTTA CORPORATION. Tenders by July 20.
WARRINGTON GAS DEPARTMENT. Tenders by May 23.

Meters and Prepayment Installations.

ASHFORD GAS DEPARTMENT (Station Meter). Tenders by May 27.
WARRINGTON GAS DEPARTMENT. Tenders by May 23.

Oil for Gas Making.

TAUNTON GASLIGHT COMPANY. Tenders by June 1.

Pipes, Specials, &c., and Pipe Line.

BRADFORD CORPORATION. Tenders by June 3.
WARRINGTON GAS DEPARTMENT. Tenders by May 23.

Steel Structures.

SHEFFIELD GASLIGHT COMPANY. Tenders by June 4.

Sulphate of Ammonia.

REIGATE GAS COMPANY.

Tar.

GAINSBOROUGH GAS DEPARTMENT. Tenders by May 23.
LEEK GAS DEPARTMENT. Tenders by May 29.

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